The

# Electrical Review

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# Atmospheric Pollution.

THE Atmospheric Pollution Research Committee of the Department of Scientific and Industrial Research has issued its first report, from which extracts are given on a later page.

Comment is made on a remarkable feature common to the records of two large cities, London and Glasgow. Between 1916 and 1922 there was a rapid improvement in the atmosphere, the total deposit being reduced in Glasgow to as low a figure as two-fifths of the original amount. Unfortunately, in both cases, 1922 saw the approximate stabilisation of the figures; since then, indeed, they have slightly worsened. Sulphate deposits, which are almost entirely due to fuel combustion, have followed exactly the same course.

The Department suggests that the number of electric and gas heaters used in substitution for coal fires reached saturation point in 1922. If that be so, two points for consideration emerge. The first is that the subsequent remarkable growth in domestic electrification has been largely due to an improved standard of living; that is to say, intermittent heating is a luxury which is in the course of becoming a necessity among those able to afford an additional sum small in proportion to the comforts to be derived.

The second point is that favourable tariffs, facilities by way of the hire of apparatus, and suitable propaganda have generally not been long enough in evidence to reach the strata of population to which labour-saving would mean the most. The need to take these numerous potential consumers into account was well brought out by the Minister of Labour at the E.A.W. luncheon last week and developed by Mrs. Wilfrid Ashley, the Minister of Transport, and Sir Felix Pole, who all stressed an aspect that appears so important to observers outside the industry. We include Sir Felix in this category because he has not been with us long enough for his objective vision to fade into the light of the common day's work.

The problem of smoke abatement is an old one—how

old is made evident in an item in our " Notes " section. The domestic coal fire is probably responsible for the worst of the atmospheric pollution in our large towns, and it has even been suggested that legal enactment would eliminate the majority of domestic fires within 15 years.

In concentrating attention on the worst offender, other sources of atmospheric pollution should not be overlooked. Thus, Newcastle-upon-Tyne, in spite of its high state of electrical development, occupies an unenviable position at the head of the table for carbonaceous deposits, and is second only to Burnley as regards sulphates. Burnley, again, is a town which reference to the special supplement to the Electrical Review of April 11th will show to enjoy an exceptionally low domestic tariff, coupled with adequate arrangements for obtaining electrical apparatus on easy terms. These two instances suffice to show that the campaign for domestic electrification should be supplemented by efforts to spread the use of electricity for industrial heating. This work demands the highest technical skill and an intimate knowledge of industrial processes other than the production of electricity, and we submit that those whose positions may be affected by the closing down of power stations would do well to transfer their attention from the thermal problems of the generation of electricity to the thermal problems of its consumption.

**Attendance at Sub-stations.**

A fatality at a sub-station, reported elsewhere in our columns this week, raises the question of sub-station staffing. In the case in point, the one attendant on night shift (11 p.m. to 7 a.m.) made a mistake while cleaning 11,000-volt insulators which cost him his life, but the disaster was not discovered until some time after.

It is possible that had there been two men on duty one might have been able to correct a mistake by the other, but this is problematical, and it is impossible to decide that the accident in the present instance would have been avoided by such an arrangement.

The employment of solitary attendants has, however, another side to it which is perhaps not appreciated by those who have not had experience of such work. Men engaged on night shift are rarely at their best; sleep during the day is unsatisfying, and they often have little opportunity or, in fact, inclination to take part in normal social life. In a power station the presence of other men and the fulfilment of sundry duties provide some alleviation, but the solitary attendant, engaged on work usually monotonous, has no such compensation. His health, under such conditions, easily falls below par and he is thus more likely to make mistakes.

On the other hand, there is really not enough work to occupy two men in most sub-stations, and employment at low pressure is satisfactory neither to an employé nor to an undertaking.

The implication is that attendance at sub-stations is an undesirable occupation and that the extended use of automatic or remotely controlled sub-stations is a consummation much to be desired.

**A Switchgear Development.**

There are two outstanding features in connection with the new type of oil-break switchgear recently introduced by Messrs. Ferguson, Pailin, Ltd., which we describe on pp. 973 and 974. One is the design of the circuit-breaker tank, and the other the stringent tests to which the apparatus has been and is subjected, both in the development and commercial stages.

Physics and mechanics both tell us that the ideal shape of a vessel of given material and weight to withstand internal pressures is the sphere, and the " bomb " testing appliances to be found in testing laboratories bear this out. Furthermore, it is claimed that the idea has met with success commercially in America.

There has always been a tendency among supply engineers to regard circuit-breaker ratings somewhat in the nature of a speculation, and although it is inevitable that any new development or claim in that direction will have to " wear down " much akin to prejudice, the results from the exhaustive testing, both research and commercial, of the equipment described, are particularly encouraging.

**The Scottish Grid.**

Departure from usual practice, in stable engineering concerns at any rate, is often an indication of the importance of a job. The Central Scotland scheme of the Central Electricity Board, which was recently inaugurated by Mr. H. S. Morrison, Minister of Transport, and is described elsewhere in this issue, being the first scheme of the Board to be adopted (1927) and completed (1930), almost wholly represents departure from usual practice so far as this country is concerned.

The scheme may be described as the " training ground " for those engaged on the work—certainly from the erection point of view—and great credit is due to the way in which the erectors tackled their job. To erect a complete grid tower in under two hours, and line construction work at the rate of five miles per week, appear to us to be remarkable.

Perhaps the difficulties to be encountered in the area had a bearing on the selection of the scheme as the first to be put in hand, but whether so or not, the results are particularly encouraging as regards the future work in connection with the construction of the grid. The river and industrial-area line spans are particularly creditable, and the three thousand odd feet span over the Forth, using towers 340 feet high, must be accepted as an achievement, even by those responsible for the long spans in America and other countries.

Commercial insulators to stand a line tension of 20,000 lb. (breaking load 65,000 lb.), with a wet flash-over value of 400 kV, represent another new departure in this country, and in this connection attention may be directed to the work which is being done at the new factory in Worcestershire of Steatite & Porcelain Products, Ltd., to which reference is also made elsewhere in this issue.

**The Faraday Centenary.**

With regard to the exhibition to be held next year at the Albert Hall, London, Sir Thomas Purves, at the annual meeting of the Institution of Electrical Engineers, made it clear that its non-advertising character (*i.e.*, the exclusion of advertising exhibits) does not in any way imply that due publicity is not to be given to the exhibition itself. Of the £10,000 which the Institution proposes to expend on the Faraday celebrations, £2,000 has been ear-marked for propaganda. It has been decided, wisely, to secure the help of the propagandist experience of E.D.A. in making known the merits of the exhibition.

**The I.M.E.A. Convention.**

Next Monday sees the opening of the thirty-fifth annual convention of the Incorporated Municipal Electrical Association at Eastbourne, and an article in this issue gives a forecast of the proceedings and local information likely to be of interest to those who propose to travel to Eastbourne.

In accordance with precedent the mornings will be devoted to the reading, in abstract, and discussions of papers. A novelty is to be introduced in the shape of an informal discussion on domestic water heating, which will take the place of one of the usual set papers. The regular features are being maintained, such as the exhibition and the official " women's day." The number of exhibitors—chiefly of domestic electrical apparatus—this year will be 41, a slight increase on last year's figure; they include Eastbourne Corporation, E.D.A., E.L.M.A., and the E.A.W. If pleasant surroundings can be accepted as an augury, and the weather is kinder than it has been of late, the Eastbourne Convention is likely to maintain the standard set by its predecessors. A report of the proceedings and a number of articles likely to be of interest to electricity supply engineers will be included in our special issue next week.

# The Eastbourne Convention.

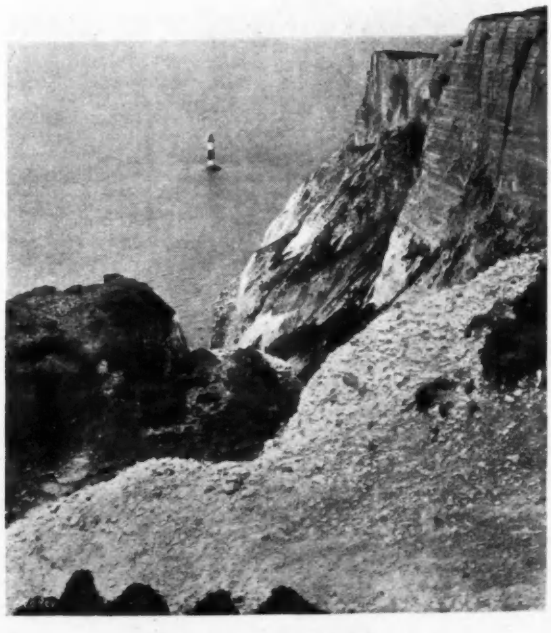
*J. Weston & Son* [*Eastbourne.*

**Headquarters, May 26th—31st.**

## Incorporated Municipal Electrical Association.

**No. I.**—*Notes featuring the amenities of the conference town and district, and outlining in advance the business and social proceedings.*

MANY of those who will attend the I.M.E.A. Convention will no doubt be encouraged by the announcements on the Southern Railway Company's property that Eastbourne held the record last year as the health resort with the greatest number of hours of sunshine. Situated at the eastern foot of the South Downs, and within easy reach of some of the loveliest of Sussex scenery, Eastbourne is undoubtedly one of the finest and most healthful watering places in the country. Although, as a hamlet or fishing village, Eastbourne has existed for upwards of a thousand years, it was not till the close of the eighteenth century that the town became popular as a health resort.

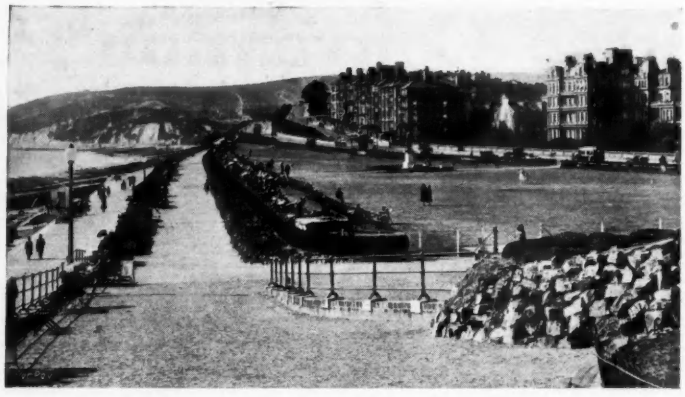


**Beachy Head and Lighthouse.**

The town, which receives pure and exhilarating air from the sea, has a seafront almost three miles in length, extending from the foot of Beachy Head to some distance past the Redoubt. The parades, which are claimed to be equal to any in the country, are divided into tiers of two or three, and in places four, broad walks, above which picturesque gardens and lawns lead up to imposing blocks of hotels and mansions. Every form of seaside amusement is well catered for. Covering some twelve acres, Devonshire Park is one of the principal places of entertainment, and it contains a spacious Winter Garden, where concerts, dances, &c., take place throughout the year, a Pavilion, in which the meetings of the Convention will be held, and in which kinematograph and other entertainments are given, a theatre, a lecture hall, a reading room, and a well-appointed tea room. The Park proper comprises the oval and middle and upper lawns, devoted to lawn tennis and croquet, and the delightful Music Garden, where, in the season, performances are sometimes given by the orchestra. Around the Park is a tree-shaded terrace forming a delightful promenade in almost all weather. A corner is specially provided for the amusement of children, with all sorts of toys and games suited to various ages. Various forms of entertainment are also available on the Pier, which supports a theatre, a bandstand, a music pavilion and tea rooms; there is also the Western Bandstand with chairs ranged along the promenades and in an extensive shelter on the middle parade. Devotees to golf, tennis, bowls, &c., will be well satisfied with the facilities afforded.

Of the public buildings, perhaps the most noteworthy is the Town Hall. The building, which was commenced in 1884, is an adaptation of the Renaissance style in dark red brick dressed with Portland stone, and is considered one of the finest town halls on the south coast. The Technical Institute, situated close to the railway station, is also well worth a visit; it contains the Municipal Secondary Schools, the Municipal Art School, a public library, reading and reference rooms, as well as a museum containing a number of geological and antiquarian specimens found in the neighbourhood, and a good collection of butterflies, moths, and birds. The Parish Church, dating from the twelfth century, was erected to replace a Saxon church of which no traces are left. Adjoining the churchyard is a building known as the Old Parsonage, which is an excellent specimen of a small sixteenth-century manor house.

Reference should be made to the Grand Hotel, Eastbourne, which will be the headquarters of the I.M.E.A.



**The Western Parades at Eastbourne.**

during the Conference. Situated towards the west end of the Grand Parade, the hotel stands in a sheltered position in its own grounds, which extend for more than three acres. The hotel has accommodation for 400 visitors, and it contains one of the finest lounges in England, a winter garden, and a magnificent ballroom.

Few places on the south coast are visited by more people than Beachy Head. Three miles from Eastbourne, with a gradual ascent, Beachy Head is one of the boldest, most romantic, and highest points of the South Downs. The inland views include the whole of Eastbourne and the low-lying coast of Pevensey Bay. The summit is 575 ft. above sea-level, and it affords some of the most varied and glorious views in the South of England. On the rocks below is the well-known Beachy Head Lighthouse, which was built in the year 1902 after the same pattern as the famous Eddystone light.

Other places of interest within easy reach of the town include Hampden Park, a fine tract of eighty-two acres, near Willington; the picturesque villages of Eastdean, Friston, and Jevington; Alfriston, with its famous old inn and cross; Litlington, Lullington and Wilmington; Pevensey, with its castle and mint-house; the historic town of Lewes; the castles of Hurstmonceux and Bodiam; as well as other seaside resorts within easy reach.

The energy which has been put into the work of organising the conference by the president, Mr. J. K. Brydges, borough electrical engineer, Eastbourne, by Mr. A. C. Cramb, engineer and manager, Croydon, the hon. secretary, and by the secretary, Mr. Jno. W. Simpson, and others, leaves it only to the weather to do its best in order to ensure a successful conference, both professionally and socially.

During the evening of the first day, Monday, May 26th, there will be a reception in the Winter Garden, Devonshire Park, by the president, supported by the Mayor of Eastbourne (Councillor Lt.-Col. Roland Gwynne, D.S.O.), which will be followed with music and dancing. Badges will be issued at the Convention Office, Winter Garden, during the first day of the Convention.

On the morning of the second day of the Convention, after an assembly by members of the Council in the Winter Garden, there will be a civic welcome at 10 a.m. by the Mayor of Eastbourne, after which Mr. Brydges will read his presidential address. At the conclusion of the president's address, Alderman R. S. Chatfield, chairman, Eastbourne Electricity Committee, will pre-

**The Pavilion, where the I.M.E.A. Meetings are to be held.**

*J. Weston & Son* [*Eastbourne.*

**The Ball Room at the Grand Hotel.**

sent a paper on the "Obligations of Electricity Committees," which will afterwards be open for discussion in the usual manner; at the same time the ladies attending the Convention will be invited to take coffee with Mrs. Brydges in the Tea Room at the Winter Garden. At 12.30 p.m. members and guests will assemble at Devonshire Park for the official photograph. The event of the afternoon will be an official visit to the exhibition, which will also be held at Devonshire Park. The list of exhibitors contains 41 names, an advance of three on the number which displayed at Torquay last year. Judging from particulars of some of the exhibits which we have received in advance, the show should be of considerable interest. In the evening, 8.15 to 8.45 p.m., there will be a reception by the Mayor of Eastbourne at Devonshire Park, who will be supported by the Deputy Mayor, Miss Hudson; dancing and music will be features of the reception.

The morning of the third day, Wednesday, will be given to the presentation of, and discussion on, a paper on "Pulverised-fuel Firing as Affecting Economic Boiler House Operation," by Mr. G. H. Lake, A.M.I.E.E., borough electrical engineer, Derby. In the afternoon there will be a visit to the Brighton electricity works, and the grid sub-station, and tea will be provided in the Royal Pavilion, at the invitation of the Brighton Electricity Committee and the Council.

The delivery of, and discussion on, a paper on the "Electric Heating of Buildings," by Mr. J. W. Burr, M.I.E.E., borough electrical engineer, Swansea, is the first item on the programme for Thursday, and it will be followed by an informal discussion on "Domestic Water Heating," which will be introduced by Mr. A. E. McKenzie, M.I.E.E., borough electrical engineer, Wimbledon. At 2.30 p.m. the Local Authority Committee members' annual meeting will be held at Devonshire Park, and the same time is fixed for the Engineers' Meeting, for members of the A.M.E.E. only, in the lecture room at the Park.

The annual dinner is to be held at the Grand Hotel, 7 for 7.15 p.m., and will be followed by dancing in the same building.

Thursday is also featured as Women's Day, under which heading a separate programme has been drawn up by the I.M.E.A. in conjunction with the Electrical Association for Women. It includes the first two items of the ordinary programme mentioned above, which will be followed by luncheon in the Tea Room (Devonshire Park). In the afternoon the ladies will inspect the apparatus at the Exhibition, and the visitors will be received by the Deputy Mayor and Mrs. Chatfield. Tea will be served in the Tea Room, at the invitation of the Eastbourne Electricity Committee, at 4 p.m.

Following the Council meeting in the room at the rear of the stage, Devonshire Park, on Friday morning, the annual general meeting of the Association will be held, and in the afternoon there will be a motor-coach trip to Bexhill, Hastings, Winchelsea, and Rye. Tea will be served in the Monastery Room at Rye. The only item fixed for the final day of the programme, Saturday, is a visit to the Eastbourne electricity works.

As in previous years, a golf competition will be held during the Convention under medal play for the "G. P. Dennis" trophy. It will be held on the course of the Royal Eastbourne Golf Club, Compton Place Road, Eastbourne, and will be open to all those who possess a Convention badge from Saturday afternoon, May 24th, until 5 p.m. on Thursday, May 29th. Any number of cards can be taken out during this period.

It is hoped that all golfers attending the Convention will play at least one round, and those who cannot find time to play may forward on their entrance fee as a subscription to the above funds to Mr. R. N. Torpy, either care of the I.M.E.A. secretary, or to the Queen's Hotel, Eastbourne.

The papers submitted at the Convention will be read in abstract, and afterwards published in full, with the discussions thereon, in the Annual Proceedings of the Association. No copies of the papers will be available at the meetings.

# The Electrical Situation in Russia.

IT has so frequently happened that optimistic reports respecting the progress of electrical developments in Russia have been accompanied or followed by statements regarding the dependence that has to be placed upon technical experience and manufacturing ability of other people, that unbelief is easy.

Of course Russia has a wonderful electrical future before it—it always had! No community, small or vast, can resist the advantages of electricity, therefore great demands for machinery, equipment, industrial and domestic apparatus are inevitable. It seems, however, that the great ambition is to dispense with electrical imports as speedily as possible. The latest dream in this connection is that of one D. Fridman in the Moscow *Ekon Zjisn* of May 10th, wherein he thinks of the electrical industry of to-day and tries to visualise that of to-morrow. Many have been the records that the Russian electrical authorities have set themselves to attain to by specified dates. That of Mr. Fridman is modestly stated as a considerable reduction of electrical machinery imports in the course of a few years, boldly indicating as the Soviet goal the occupation of the second place in the electrical manufacturing industry of the world by the end of the fiscal year 1932-33! According to Mr. Fridman, the production of transformers, motors, and oil-insulated switches has not yet been accelerated as it might have been by running two to three shifts, scrapping worn-out plant, and adopting more effective technical processes. The writer declares that Russian producers have learned long ago from Western Europe and America how to avail themselves of foreign assistance so as to be able, by independent technical progress, to liberate themselves from imports "which is faced as a fighting problem."

Turning from these very general assertions to matters of detail, we find it stated that during the present year the second section of the Elektrosil works will be completed for the production of steam turbo-generator sets up to 110,000 kW capacity, thus diminishing the necessity for further imports of this class. At Kharkoff a beginning has been made with the erection of turbo-generator works for producing sets of from 44,000 to 200,000 kW, "that is to say, the maximum size now used in practical work." At the Elektrozavod works at Moscow the construction of large transformers up to 40,000 kVA has been begun, and it is expected that a similar large works will be commenced this year.

At the extended Leningrad works of the Elektro-apparat oil-break switches and other apparatus up to 220,000 volts will be manufactured this year.

With these factories in being the Russian electrical industry is thus regarded as being in a favourable position, so that, as it has its own special staffs and first-class foreign consultants and technical assistance, no special difficulties will hamper its productive activities. We do not, however, ourselves, regard these statements as indicating that British electrical manufacturers have nothing to gain by indulging in active operations in the vast market. So far as money is concerned, we have the usual vague estimates once more, such as: during the present and next year the capital of the electrical industry will be increased by about 200,000,000 roubles, the basis capital being augmented more than twice for new equipment and new manufacturing undertakings, thus, as is repeated, bringing the country nearer to independence of imports.

If we may be permitted to vouchsafe a word of advice to our Russian electrical confrères—for we desire to see electrical development make progress in all parts of the world—let us suggest that the pace toward the desired goal will be accelerated by the use of fewer hot and cold forecasts and more genuine desire to co-operate with British electrical interests upon a sound economic basis, with a simultaneous due recognition of past liabilities.

# The Royal Society's Soirée.

## An Account of the Annual Exhibits and Demonstrations of an Electrical Nature.

THE annual conversazione of the Royal Society (president: Sir Ernest Rutherford, O.M.) took place on May 14th at Burlington House, the customary display of scientific apparatus and demonstrations having been arranged by some 24 exhibitors.

Sir Robert Hadfield, Bt., F.R.S., amongst specimens indicative of special properties and applications of ferrous alloys, had an electric furnace on view having heating elements of the new R.H.* heat-resisting alloy which has the high electrical resistance of 134 microhms per cu. cm. at 20 deg. C., with a low and uniform temperature coefficient of 0.000075 per deg. C., combined with remarkable resistance to heat scaling. By its means furnaces of the resistance type can be maintained continuously at temperatures as high as 1,200 deg. C. The furnace exhibited had been operated between 1,150 deg. and 1,250 deg. C. for a total period of over 2,000 hours; the heating elements are still in good condition and give promise of a much more extended service.

He also showed specimens illustrating the difference in the effect of mechanical deformation on the non-magnetic properties of manganese steel and austenitic nickel-chromium steel, both of which are non-magnetic in their ordinary condition; while the non-magnetic property of the former is unaffected, the latter is rendered fairly strongly magnetic.

*National Physical Laboratory.*—Some of the work carried out for the Radio Research Board of the Department of Scientific and Industrial Research was indicated, including (i) a 1-kW two-valve transmitter and a simple two-valve receiver for operating on wavelengths between 4 and 10 metres. (ii) The method of making aural observations of the Orfordness rotating wireless beacon was demonstrated with the aid of a special stop-watch, an image of which was projected on to a screen, its seconds hand having been set to rotate in synchronism with the beacon; a synchronously rotating drum also recorded the signals automatically. (iii) Frequency analysis of a modulated continuous oscillation was demonstrated graphically by a spot of light projected on to a screen moving according to the current flowing in the circuit as its tuning was varied. (iv) Apparatus devised for friction and wear tests on pivots and jewels, enabling a pivot to be rotated in contact with a jewel under a known load. The pivot is mounted in a vertical spindle, and supports a disk by means of a jewel mounted at the centre of the disk, which can be maintained stationary by means of a magnet lying on the upper surface of the disk whilst the pivot rotates. The apparatus has eight spindles, so that eight tests can be carried out simultaneously; all the spindles are driven from one horizontal shaft, and a counter enables the number of revolutions executed by each pivot in the course of a test to be determined. Wear of the pivot and jewel surfaces occurs as the pivot rotates, and its effect is to increase the torque due to friction between the pivot and jewel. The apparatus can also be used to measure the torque at any time during the progress of a wear test, and the effect of wear in causing an increase of friction can thus be measured.

*General Electric Co., Ltd.*—(Research laboratories: Messrs. J. T. Randall & H. P. Rooksby). This exhibit of X-ray photographs and crystal models illustrated the structure of vitreous and amorphous solids. For instance, it has been thought for many years that the atoms which make up a glass are in a completely unordered array; in other words, that glass is "amorphous," which is, of course, in distinct contrast to the ordered arrangement of atoms in crystals. If a beam of X-rays is passed through a crystalline powder, the particles of which are 1/10,000 of a mm. in size, a series of sharp rings is produced on a photographic plate placed behind the powder. As the particles decrease in size the rings broaden out according to well-known laws, until for particles one-millionth of a cm. in diameter the sharp rings are replaced by bands. The X-ray patterns for glasses also consist of one or more broad bands. It is therefore natural to ask whether a glass is built up of extremely small crystals. If it is, then some correspondence is to be expected between the diffraction pattern of the crystals from which the glass was made and that of the glass itself. It has been found that such a correspondence does exist in many cases, *e.g.*, between cristobalite and vitreous silica; between pseudo-wollastonite ($CaSiO_3$) and its glass; between $Na_2B_4O_7$ and the glass. Usually wherever a strong ring occurs for the powdered crystals a band appears in approximately the same position for the glass. The size of the crystallites has been calculated from the observed band widths which make up the glass and lies between $10^{-6}$ and $10^{-7}$ cm. It has also been possible to predict the diffraction pattern for given substances when the crystals are reduced to this order of size. There is good agreement between the observed and calculated patterns.

*H.M. Arsenal, Research Department, Woolwich.*—X-ray spectra showing variations in crystal orientation of copper, and a suggested method of examining long cylinders visually for flaws; by means of an optical arrangement a fluorescent screen may be viewed at a distance and suspicious marks on the interior surface of a long tube may be first identified by ordinary illumination and then by the interposition of a screen, while the area may be irradiated by X-rays and viewed on a fluorescent screen.

*Building Research Station* (Mr. A. F. Dufton) exhibited a microvolt-hour meter devised for investigating the flow of heat at a window, into or out of a room; the apparatus produces an electromotive force of 70 microvolts for a heat flow of one British thermal unit per square foot per hour, and affords a continuous record of the flow. With intermittent sunshine the continuous record is naturally difficult to integrate, and an integrator has therefore been devised to "meter" the heat flow. This instrument works from a.c. mains and operates a six-figure counting train, one unit corresponding to one microvolt-hour.

*Solar Physics Observatory, Cambridge, and the Cambridge Instrument Co.* showed a recording microphotometer designed for the study of spectrograms and photographs up to a size of 12 by 10 in. By a suitable optical system light from an incandenscent lamp is concentrated on to a minute area of the plate, the transmitted light falling on a slit over a photo-electric cell whose width controls the area of the plate which is studied at any one time. The photo-electric current passes through a Koch resistance cell and the potential across the cell is measured by a Lindemann electrometer. The pointer of the latter is projected on to the camera and its movements correspond to the density changes which are taking place in the plate as it is traversed. The whole carrier is moved by a motor-driven screw, which also rotates the drum of the camera, so that the movement of the latter bears a definite relation to the movement of the plate.

# The Scottish Grid.

**A brief description of the Central Scotland Scheme of the Centra Electricity Board, the first of the Board's schemes to be adopted and completed.**

By DONALD SMEATON MUNRO, M.I.E.E.

THE Central Scotland Scheme of the Central Electricity Board, which was officially inaugurated by Mr. H. S. Morrison, Minister of Transport, on April 30th (ELECTRICAL REVIEW, May 9th, p. 888) was the first of the great grid schemes to be adopted by the Board, in June, 1927; Messrs. Kennedy & Donkin were the consultants. Of the six schemes in active progress, the area covered and the percentage of population compare most nearly with the N.E. England Scheme of 1929. The Scottish area now served has 3¾ millions of inhabitants, is roughly 4,980 sq. miles in extent, and it includes all the important industrial and engineering districts in the country. Within the area there are 42 authorised undertakers, eight of whom own selected stations, namely, Portobello, Clydes Mill and Yoker, fig. 5, Dalmarnock, Bonnybridge, Townhill, Carolina Port, Kilmarnock, and the coupled hydro-electric power houses of Stonebyres and Bonnington. In addition, one station in the East and one in the West are contemplated.

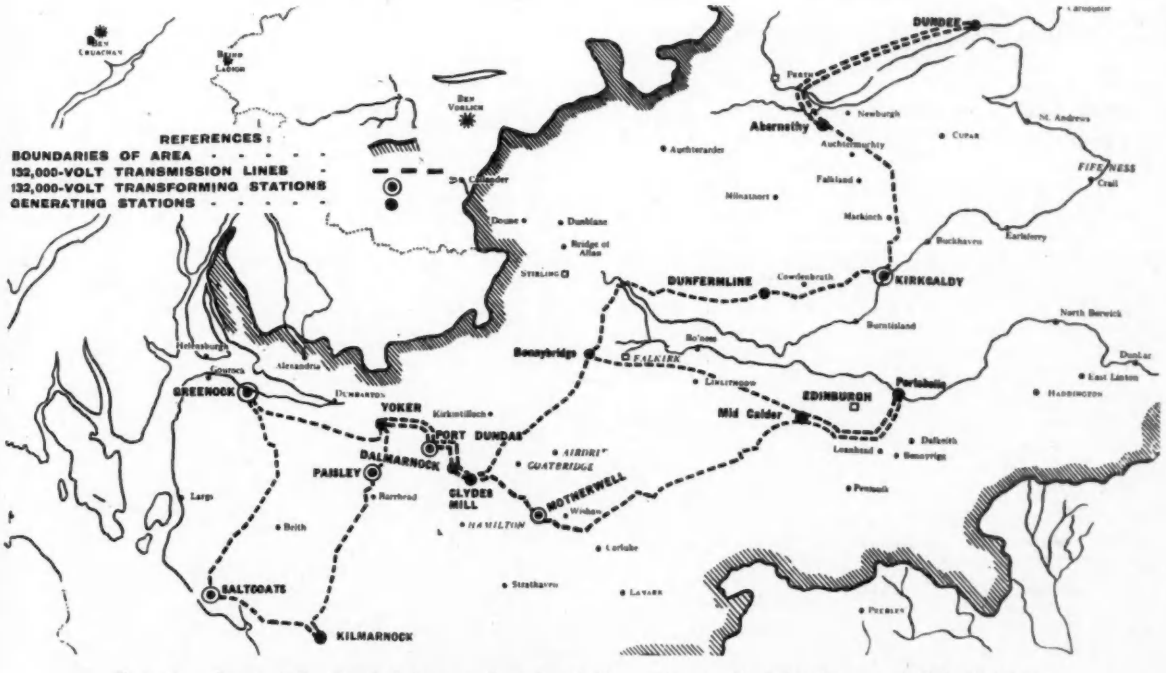



**Fig. 1.—Central Scotland Scheme; Overhead Lines, Generating Stations, and Sub-stations.**

The main transmission lines, at a pressure of 132,000 V, follow the course indicated on the map in fig. 1, and form a kind of national bus-bar which will meet all the variations of demand. They make available to any undertaker the reserve power aggregate of all the selected stations in the area. The main lines extend to 246.6 route miles, and comprise 187 miles of single- and 59.6 miles of double-circuit line, connecting 15 stations. The following power stations owned by the Corporations of Dundee, Kirkcaldy, Edinburgh, Glasgow, Paisley and Greenock are included; these are, respectively, Carolina Port, Kirkcaldy, Portobello, Dalmarnock and Port Dundas, Blackhall, and Dellingburn. The Clyde Valley Electrical Power Co. has three stations connected, namely, Motherwell, Clydes Mill, and Yoker. The Lanarkshire Hydro-Electric Co. has the Stonebyres and Bonnington stations. The Scottish Central Power Co. has Bonnybridge, and the Fife Electric Co. has Townhill, Dunfermline. The total of 15 is completed by Kilmarnock, which is owned by the Ayrshire Electricity Board. In addition to these, grid points are established at Saltcoats in the south-west and Abernethy in the north. The former will give a supply to the Ayrshire Electricity Board at the coast, and the northern point will receive a bulk supply from the Rannoch hydro-electric station, which is under construction for the Grampian Power Co.

## The Transmission System.

The varied nature of the country covered by the scheme made the work of planning the transmission lines very difficult and interesting, for the 132-kV conductors had to span navigable rivers and penetrate the dense chimney areas of big towns. There were beauty spots to be preserved and landowners to be conciliated. Now that the deed is done there is a sub-station on the site of a palace of the Pictish Kings, a line tower where Prince Charles Edward planted his carronades, and several in the fields of secluded Swanston Farm, beloved by R. L. Stevenson. Yet so graceful are these structures that no one can rightly say that they are incongruous. The highest towers are those at the Forth crossing, fig. 2,

where the span is 3,050 ft., and the twin, though widely-separated towers, of graceful Eiffel design, rise to 340 ft. When viewed from the old world village of Dunmore the towers are most impressive, soaring as they do from the flat banks of the broad river, and they

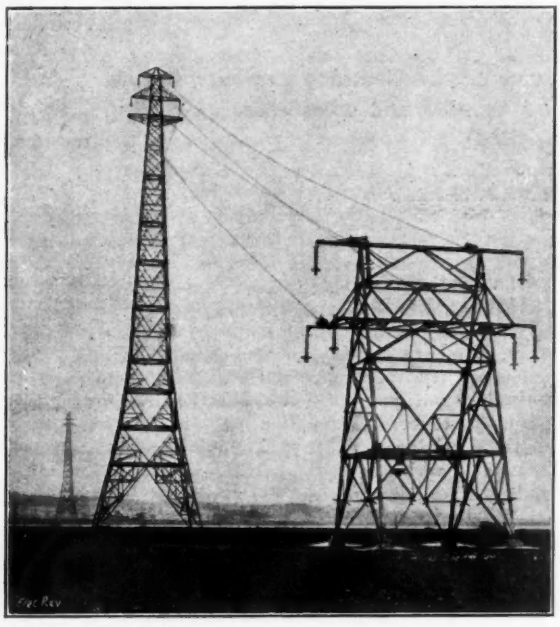


**Fig. 2.—River Forth Crossing and Anchor Towers at Kincardine.**

are within sight of Alloa, the birthplace of Sir Archibald Page, chief engineer to the Central Electricity Board.

An important western river crossing is over the Clyde from Yoker to Renfrew, where the span is 980 ft. and the towers carry a double circuit. The Yoker tower is 270 ft. high, and it serves as a crossing as well as a terminal tower for the " high-type " sub-station, fig. 5. Not far from Renfrew another pair of towers, 218 ft. high, are used for the River Cart crossing. In the northern section, near Abernethy, the Tay and Earn are spanned for a total length of 1,350 ft., and the towers in these cases are 187 ft. high. All these river towers, with the exception of those at Yoker, carry only the weight of the conductors and the earth wire, the stress being taken by specially stiff anchor towers placed a normal span length behind the lofty supports. The tension on the insulators is naturally very great at these long crossings, and at the Forth, where the conductor tension is 20,000 lb., three insulator chains are used in parallel. The electro-mechanical test on these chains is 50,000 lb., and the breaking load is 65,000 lb. Twelve units are used in each string, and the complete insulator has guaranteed minima dry and wet flashover values of 510 and 400 kV, respectively. On this particular span a special conductor of 19/0.125-in. steel stranded core surrounded with 18/0.125-in. aluminium strands is used. The sag is 150 ft., and the stress per conductor is 20,000 lb. Normally the transmission-line conductors consist of 30/0.110-in. aluminium wires and 7/0.110-in. galvanised-steel wires, jointed under strain by " Pairard " junctions.

A continuous longitudinal steel-cored aluminium earth conductor made up from 12/0.110-in. aluminium over 7/0.110-in. compounded and galvanised-steel core is run above the conductors. One such earth wire is used both for single- and double-circuit towers as an earth and electrostatic protector, and the conductor is veed out over the sub-stations. Earthing of the towers is effected at their own footings, or when these are in concrete by copper strip led in c.i. pipe. Four standard types of towers are used for single-circuit and three for the double-circuit lines. Each type has three standard extensions, 10 ft., 17 ft. 6 in. and 25 ft., to meet irregularities of the base contour. The heights are designed to give 22 ft. ground clearance under normal conditions on a 900-ft. span.

The erectors acquired great skill in the course of the work, and in a test prepared under " all-ready " conditions a complete tower was erected on its foundations within an hour and three-quarters. The maximum high rate of line construction of five miles per week was attained. Some notion of the magnitude of the line work as carried out by British Insulated Cables, Ltd., may be gained from the fact that about 5,000 tons of steelwork, 1,200 miles of stranded conductor, and 70,000 porcelain disk insulators are used. Normally the 10-in. disk insulators are arranged nine in series and fitted with arcing horns at the earth end and an elliptic guard ring at the conductor end of the string. Tension insulators are designed for a minimum flashover under worst Scotsmist conditions of 280 kV. One of the chief problems has been the cabling up of the main power transformers to the station bus-bars. In one instance 90,000 kVA has to be dealt with at 6.6 kV. In this case it has involved running six 1.0-sq. in. cables in parallel per phase. That meant the sealing off of about 70 cable ends, including connections between the main power transformers and potential and auxiliary transformers. Generally such cables have been laid in concrete waved troughing. The multicore wiring has been effected by means of main trunk cables of a large number of cores between the control room and 132-kV site. An average station required 170 cores contained in five cables. Fig. 3 shows the eastern terminal of the 132,000-V line at Portobello.

### The Sub-stations.

The absence of special lightning-surge arrangements, and the low formation adopted, as a rule, make the Scottish transformer station less complicated than most of those which the I.E.E. inspected in France last year. Each is built on a concrete raft and is provided with flood lights on high pillars for safe night operation. All the sub-stations, with the exception of Dalmarnock, Greenock, and Yoker, are of the " low type," fig. 6,

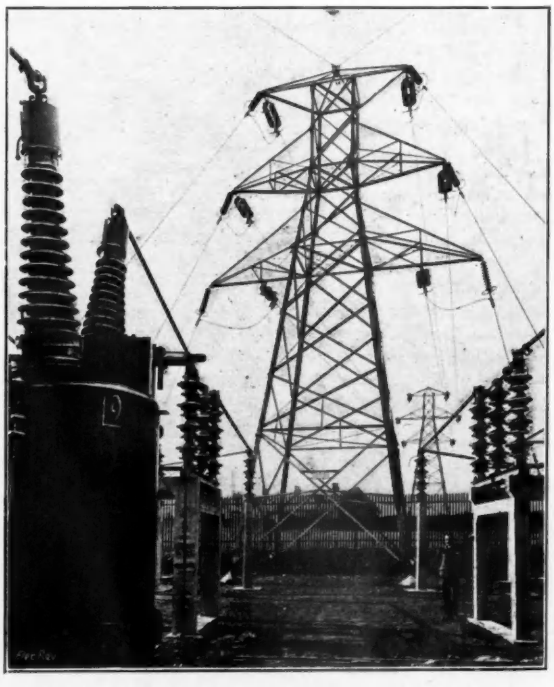


**Fig. 3.—132-kV Line Terminal at Portobello.**

seven of these, *viz.*, Saltcoats, Paisley, Port Dundas, Clyde's Mill, Motherwell, Dunfermline, and Kirkcaldy, are of the three-switch, two-line type, while Kilmarnock, Portobello, Bonnybridge, fig. 7, and Dundee are designed for three incoming lines and five oil-break

switches. Dalmarnock sub-station, of the " high extensible " design, forms the junction point of two complete rings, and it has seven oil-break switches, four of which are for the control of lines, two for transformer control, and one acts as a bus-bar coupler.

Abernethy sub-station, of the " low type," provides a junction point for the Grampian Company's 132,000-volt lines with the Central Electricity Board's system. The connection, however, will be made through two 20,000-kVA, one to one-ratio buffer transformers provided with tertiary windings of 5,000-kVA capacity for giving a 33,000-volt supply to the Grampian Company's secondary transmission system. This sub-station provides for the control of five 132,000-volt lines, two connecting to Dundee and one to Kirkcaldy, in addition to the Grampian Company's lines.

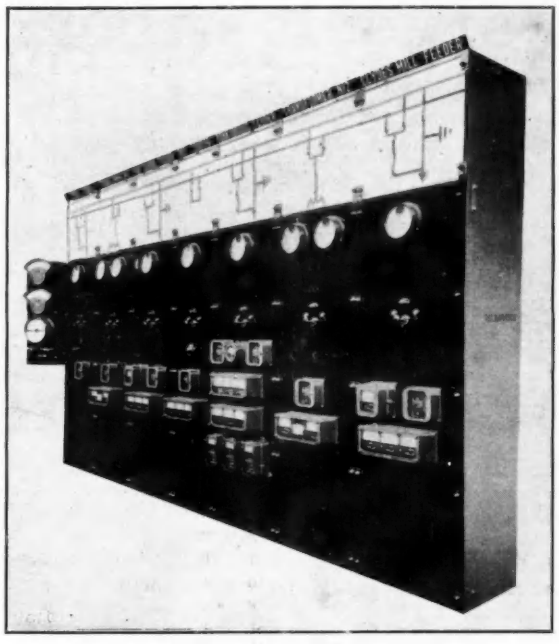


**Fig. 4.—A Typical Grid Control Board.**

Particular interest attaches to the sub-stations at Greenock and Yoker, because of the restricted areas of the sites. At Yoker special switching arrangements were adopted in order to provide for both 25- and 50-cycle supplies to the Clyde Valley Co. during the standardisation of frequency period. This necessitated the provision of one transformer of 30,000-kVA capacity and two of 15,000-kVA capacity, a similar arrangement being made at the Glasgow Corporation station at Port Dundas. At the latter station, however, the transformer banks are of 20,000-, 20,000-, and 45,000-kVA capacity.

Fig. 5 gives a general view of Yoker sub-station, together with the terminal tower for the incoming lines from Port Dundas and from Greenock and Paisley. Greenock sub-station, because of the extremely restricted nature of the site and its position relative to the direction of the incoming lines, and of the fact that the surrounding land was covered with industrial works and tenement properties, was difficult to approach. At Dundee an interesting departure has been made from the usual practice: owing to the difficulty of obtaining sufficient accommodation at Carolina Port power station for a complete sub-station, the transformers and 132,000-volt switchgear are placed on separate sites. The switching station is located about 1,400 yards from the 132,000-volt transformers, and is remotely controlled from the power station. Two 132,000-volt lines (one to each transformer) connect the switching station directly with the transforming station and " drop " on to the transformers without the interposition of further switchgear.

**Transformers.**

The range of transformer sizes in use in the Central Scotland area includes capacities of 10,000 kVA at Dunfermline and Kirkcaldy, 15,000 kVA at Paisley, Yoker, Saltcoats, and Dundee, 20,000 kVA at Kilmarnock, Greenock, Port Dundas, and Bonnybridge, 30,000 kVA at Yoker, Clyde's Mill and Motherwell, 45,000 kVA at Port Dundas and Portobello, and 60,000 kVA at Dalmarnock. All transformers having a 6,600-volt secondary pressure have the secondary winding in two sections, which can be paralleled in order to provide a secondary pressure of 3,300 volts, if required. Similarly, transformers wound for 22,000 volts secondary pressure can be arranged for 11,000 volts. The very-

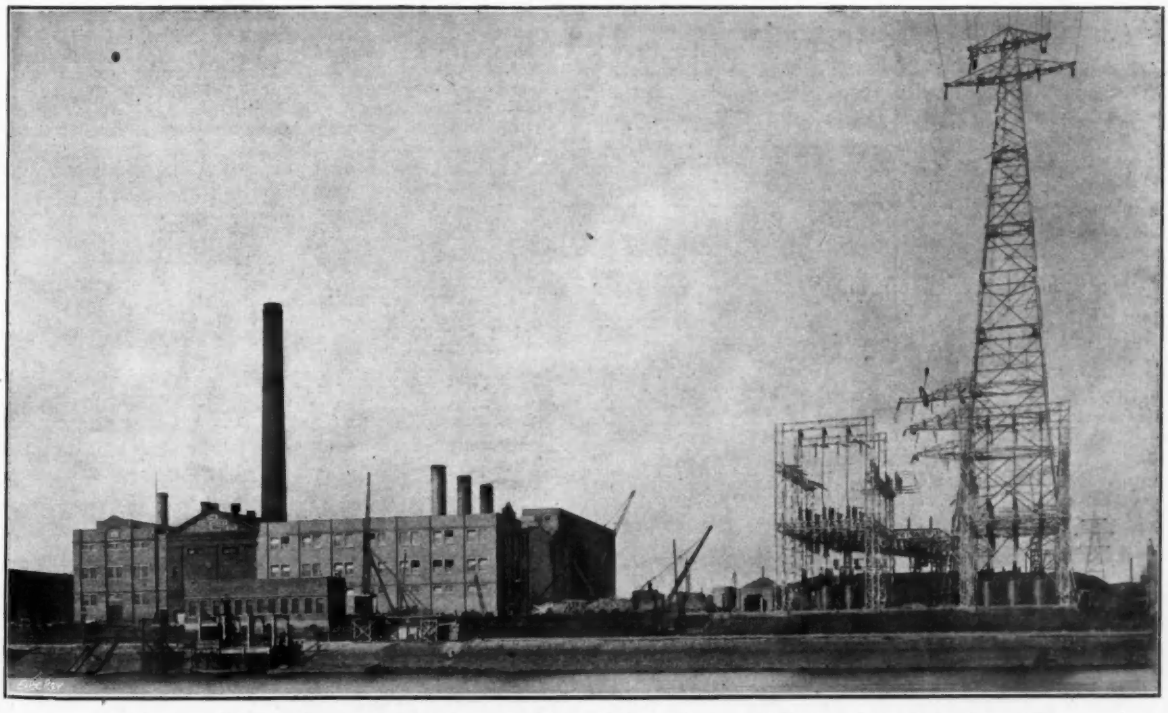


**Fig. 5.—Yoker Generating Station, 132-kV Sub-station, and Tower for Clyde Crossing.**

large secondary currents which require to be dealt with at pressures of 3,300 and 6,600 volts introduce real difficulties. At Portobello power station, with a bus-bar

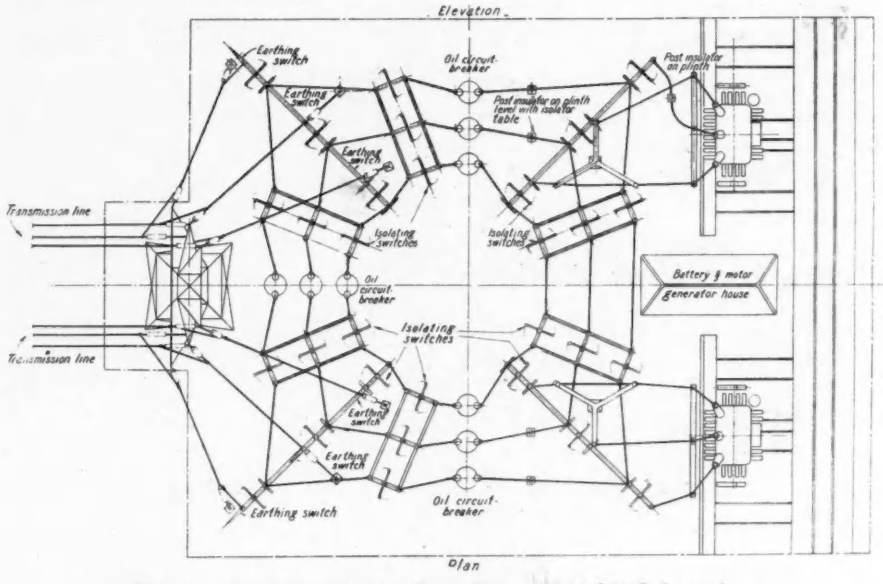



**Fig. 6.—Arrangement of " Low Type " 132-kV Sub-station.**

pressure of 6,600 volts, and transformers each having a capacity of 45,000 kVA, the lower-pressure grid connection has to carry a current of 4,000 amperes. As it was considered inadvisable to handle all this current on one 6,600-volt circuit breaker, two switches have been installed for each transformer bank. As the majority of the sub-stations in the scheme are unfavourably situated for rail transport, the transformers have had to be delivered by road.

All the transformer banks up to a capacity of 30,000 kVA are of the three-phase type, and transformer banks having capacities in excess of this are made up of three single-phase units. The method of tap changing provides for operation under load conditions, and the actual alteration of taps for the adjustment of voltage is made from the undertakers' stations under the general direction of the Board's control engineer. The equipment provides for a plus or minus boost of 10 per cent. on the standard pressure of 132,000 volts. The system of cooling employed varies with the size of the transformer. On the 10,000-kVA sizes natural air cooling is provided, while on the 15,000-kVA equipments the cooling is effected by natural oil circulation with forced-air cooling. On the larger sizes, again, *i.e.*, 20,000 to 60,000 kVA, a combination of forced oil circulation and forced air blast is employed. The protective means provided consist of overload and leakage relays for both high- and low-pressure windings.

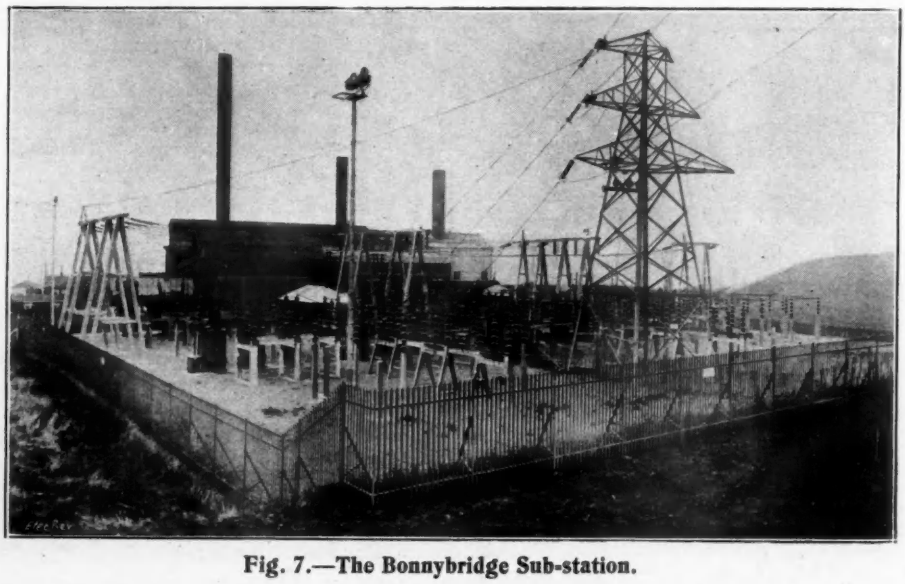


**Fig. 7.—The Bonnybridge Sub-station.**

### General Control.

The general control of the interconnected grid, by telephone, will be effected from a control room at Dalmarnock, and the operation of all oil-break switches at the sub-stations will be carried out by the various undertakers' staffs on indication from the control engineer. Fig. 4 shows a typical control board.

The operation of the Central Scotland Scheme as a unified area on one uniform periodicity is hampered by the necessity for standardising the frequency in the areas of the two largest authorised undertakers, *i.e.*, the Glasgow Corporation and the Clyde Valley Electrical Power Co. These undertakers generate 59 per cent. of the output of all the undertakers within the scheme, and, until all the generating plant and consumers' plant in the areas of these undertakers are altered from a frequency of 25 cycles to the standard frequency of 50 cycles, no comprehensive scheme of control for the whole area can be put into force. A full realisation of the benefits of interconnection and selective operation of generating stations will not be obtained until this work is completed. Standardisation of frequency was commenced in the areas of the two undertakings in 1929, and it is anticipated that the area will operate on a uniform frequency by 1932.

### Constructional Progress.

Apart from the necessary delay in connection with frequency changing, it was arranged that the work should be completed in three years. The first contracts—all British—were placed in December, 1927, and what little remains to be done will be finished in a few months.

The following is a list of the principal contractors, and the Board has acknowledged the creditable way in which they have fulfilled their obligations:—

Transmission lines, British Insulated Cables, Ltd. River crossings, J. L. Eve Construction Co., Ltd. Civil engineering work (sub-stations), Melville, Dundas & Whitson; John Train and Co., Ltd.; William Bain & Co., Ltd.; T. P. Jamieson; Thomas Miller & Sons; George Smith; R. J. Morrison; John Paterson & Son, Ltd.; and John Angus & Sons. Switchgear, Metropolitan-Vickers Electrical Co., Ltd.; British Thomson-Houston Co., Ltd.; General Electric Co., Ltd.; A. Reyrolle and Co., Ltd. Transformers, British Thomson-Houston Co., Ltd.; Ferranti, Ltd.; and Metropolitan-Vickers Electrical Co., Ltd. Remote indication, Automatic Telephone Manufacturing Co., Ltd. Oil-filtering equipment, Stream Line Filter Co., Ltd. Earthing resistances, Ferguson, Pailin, Ltd.

# Shannon Hydro-electric Scheme.

**A descriptive account of the layout and equipment of the initial portion of the Ardnacrusha power plant built by German contractors for the Irish Free State water-power development project.**

By CHAS. J. WEBB, A.I.A.E.

(*Continued from page* 906.)

## Switchgear Details.

The switchgear throughout is based on the double bus-bar system to enable different sections of the system to be worked separately or coupled together. The 110-kV switchgear is an outdoor installation (fig. 12), the 10-kV and 38-kV control gear (fig. 13) being indoors and a combination of the cubicle and multi-storey systems. The oil switches are of the single-tank suspension type separated by concrete partitions. The nominal current rating of the switches for the 30,000-kVA distributors is 2,000 A and that of the remainder 600 A.

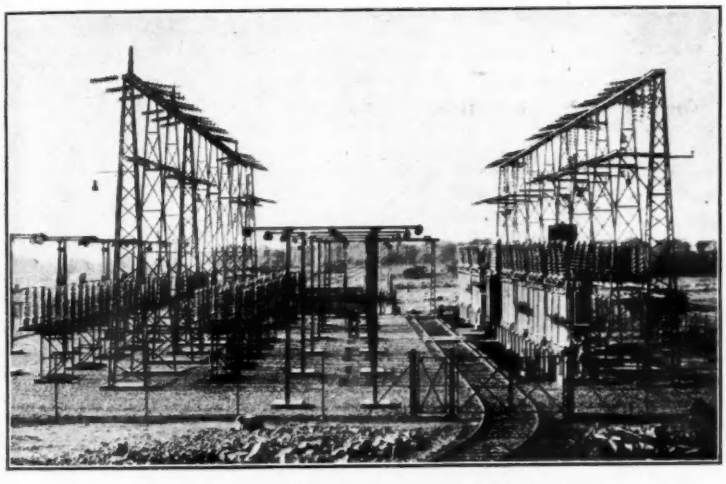


**Fig. 12.—Ardnacrusha 110-kV Sub-station.**

Each 10-kV and 38-kV switch has a cylindrical oil tank surmounted by a cast-steel cover penerated by six "Repelit" bushings. The cover is bolted to a flange frame, from which the switch is suspended. When the flange frame is taken apart a special winch truck enables a complete switch to be raised and lowered through an opening in the ceiling; the tank can be lowered by itself.

The whole of the switches are operated from one gallery and a cement wall completely shuts off the operating gallery from the h.v. gear, pilot lamps showing the positions of the oil switches; the isolating switches are operated by crank handles through worm gearing. The duplicate bus-bars in the uppermost storey consist of copper strips and undue strain on the supporting insulators is avoided by the provision of flexible copper expanding pieces. Complete phase separation is provided throughout, *i.e.*, not only are the duplicate bus-bars separated by partitions, but screens of hard cement plates are also inserted between the phases of each system. To enable load tests on the generators to be carried out, a water resistance is connected to the 10-kV bus-bars and the depth of immersion of the electrodes is controlled by a sluice gate remotely-operated from the control room, the limit positions being indicated by pilot lamps.

The 38-kV switch house is planned on similar lines to the 10-kV house and is constructed of reinforced concrete, only the roof being of steel. The building has three floors, connected by staircases and a lift, and in order to reduce building costs the transformers have been placed outside, while the inside apparatus is built into cubicles. All switches are operated from a common gallery.

In consequence of the various ground levels around the sub-station a motor-driven cable hoist for a load of 45 tons has been provided for the transport of the 110-kV oil-switches and 38.5-kW transformers to the rail head about 50 ft. below the station level on a truck travelling on double-rail track inclined at an angle of about 25 degrees.

## Control Room Details.

As has already been indicated, the whole of the switchgear is controlled from one central switchboard (fig. 16) consisting of 66 panels and 19 desks in concentric semi-circles. The bus-bars and feeders are represented by coloured strips and all oil switches and isolating links are provided with position indicators, which are also

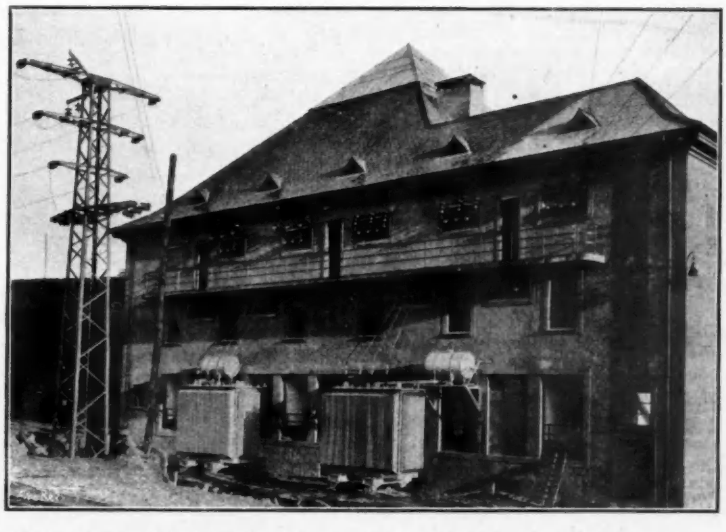


**Fig. 13.—38-kV Switch House and 8,000-kVA Transformers.**

incorporated in a connection diagram that serves several purposes. It enables the switchboard attendant to note at a glance the positions of all the switches; alterations in the positions of any switches are announced by an ocular signal and by manipulating the position indicators previous to giving the signal to operate the switches the attendant can convince himself by a survey of the illuminated diagram of the correctness of the manœuvre. All transformers are equipped with danger-signalling apparatus and Buchholz protection gear, the operation of which is also rendered visible on the desks as is that of all other protective gear. The shunt regulators for the exciters are located in the basement and are operated by hand wheels on the front of the switch desks. Generally, however, hand regulation is unnecessary as the generators are provided with Thoman automatic quick-acting voltage regulators. Apart from the main switchboard, the control room also contains a 28-panel board for the station services, while a further 22-panel board contains the whole of the relays for the various protective devices.

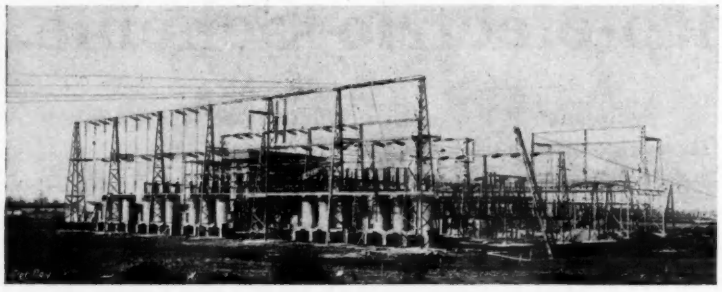


**Fig. 14.—Dublin 110/38-kV Transforming Station.**

### Transmission Lines.

The outgoing 38-kV lines are provided with impedance and excess-current protection gear. The duplicate 110-kV line to Dublin (116¼ miles) is equipped with balanced-feeder protection, while the single 110-kV line to Cork (59½ miles) has excess-current protection gear. A centralised system of signalling and danger signal gear notifies the switchboard attendant of the operation of any of the protection apparatus. Furthermore, the control-room is in communication with the more important parts of the station by automatic telephones, as well as with the outdoor sub-station, whilst several of the telephone stations are linked to the public service, and it is possible to switch them over to the high-frequency power-line system, so that the engineer can at all times communicate with the switchboard attendants of the 110-kV transformer sub-stations.

The 38-kV distribution system is fed from the main generating station at Ardnacrusha and by main step-down stations at Dublin and Cork (fig. 15). From the generating plant a duplicate 110-kV transmission line runs to Dublin and a single three-conductor 110-kV line to Cork where the voltage is stepped down to 38 kV. When the scheme is fully developed it is intended to provide the 38-kV station at Maryborough with 110-kV equipment and then to use it as a fourth feeder station for the 38-kV distribution network.

### Sub-stations.

The Dublin transformer station (fig. 14) is of the outdoor type with three 15,000-kVA, 110/38-kV, transformers. From the double bus-bars run three cables and two free connections for supplying two sub-stations in the Dublin district; there are also three connections to two 38-kV distribution loops in the eastern part of the Free State. The 110-kV transformer station is very similar to that at Ardnacrusha. The 38-kV switchgear differs, however, from that at the power station in that it is located outdoors; the oil switches have a capacity of 300,000 kVA and are of the single-chamber type, remotely controlled.

The Cork 110-kV transformer station contains at present two 10,000-kVA triple-wound transformers and is intended to supply the south-west loop at 38 kV and the Cork district at 10 kV, the establishment of a special 38/10-kV sub-station in the city having thus been avoided. The 110- and 38-kV switchgear is of the outdoor pattern and is similar to that at Dublin. The 10-kV switchgear is, however, mounted inside a small building.

*(To be continued.)*

**Fig. 15.—Map of Distribution Lines.**

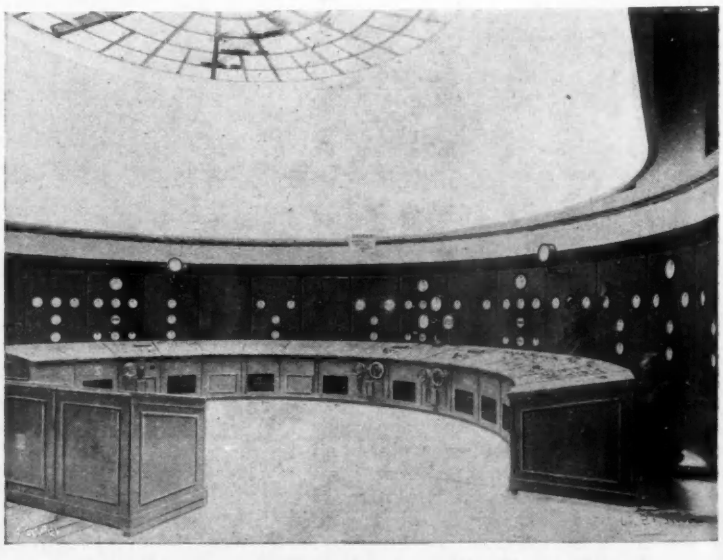


**Fig. 16.—Control Room at Ardnacrusha Power Station.**

# The Engineering Degrees of the University of London.

**Some criticisms of the University Regulations, with particular reference to the cultural education of the engineer and the difficulty of reconciling the attainment of a high external degree with the acquisition of engineering experience.**

**(Communicated.)**

THE University of London is unique, in that it was originally established, not as a teaching institution, but solely as an examining body for the granting of degrees. The function of the University in supervising the teaching work of schools affiliated to it is a comparatively late development, and this development has resulted in the present situation that two kinds of examinations are held for the same degree. Students attending the " schools of the university " may be registered as " internal students," if they follow an approved course of study for the degree which they desire. The attainment of the degree is then conditional on their having made a stipulated number of attendances at the school to which they are attached, and the examination for their degree includes a review of their work in the school. Students who are unattached to any school of the university are known as external students, and the granting of a degree to such students depends entirely on the results of the examination held by the University. The examinations for external students are usually considered more difficult and searching than those for internal students who have followed prescribed courses of study in the schools of the University.

The B.Sc. degree in Engineering of the University of London is held in high esteem as indicating a sound knowledge of the theory of engineering. The possession of this degree gives exemption for all or the greater part of the examinations for corporate membership of the professional engineering institutions, and as an educational qualification it certainly stands higher than the passing of the examinations of these bodies. The possession of a degree in engineering is, moreover, a *sine qua non* for applicants for many Government engineering posts.

To those who have not had the opportunity of following courses of study at a University College, the University of London offers the opportunity of obtaining a degree by spare-time study. To prepare for the degree by working in the evening is an arduous task, but one which is within the capabilities of those of good intelligence and capacity for application. Apart from the advantages referred to above, the gaining of an engineering degree does not, of itself, bring an immediate return, and the degree will probably be found more useful to those who have had some years of practical experience in the profession, than to those who have just left a University College. An outstanding advantage of an engineering degree in applying for a post is that the matter of educational qualifications is settled at once.

In spite of the general esteem in which the London degrees in engineering are held, these degrees are open to some criticism on the score of the narrow field covered by the examinations for them. To appreciate the ground of this criticism, the subjects of the three examinations for this degree may be briefly reviewed.

Before embarking on a specific course of study for an engineering degree, it will be necessary for the student to pass the matriculation examination, or one equivalent. In studying for this examination the foundation of a liberal education will be laid. We may observe, however, that a recent revision of the Regulations for Matriculation in the University of London enables a student, by attaining to a higher standard in mathematics, to take a relatively easy examination in the one foreign language which is compulsory.

For the intermediate examination for the B.Sc. (Engineering) degree the compulsory subjects are mathematics, engineering drawing, heat, and electricity. In addition a fourth subject of a scientific character must be offered. The mathematics in this examination are elementary, but the examination is difficult. The science subjects are relatively easy. For the examination in engineering drawing a knowledge of the elements of machine design is required, such as is found in Low and Bevis. The drawing exercise is fairly difficult, and calls for some skill in draughtsmanship.

Five subjects must be offered at the final examination for a pass degree. Three of these must be chosen from a group of four, comprising the theory of machines, the theory of structures, the strength of materials, and electrical technology. For the remaining two subjects a relatively wide selection is given; the group from which this selection is made comprises three electrical subjects, electrical machinery, electrical power, and electrical measurements, and also mathematics. An electrical engineering student can thus offer three electrical subjects, and must offer two non-electrical subjects. The standard required for a pass is, quite properly, high, but the examination is a perfectly fair one, and, with one exception, no student who has conscientiously studied the subjects in which he presents himself, need fear failure. The exception referred to is mathematics, the examination in which is really difficult. This subject should be avoided by all but those who have a real aptitude for it.

It appears from a review of the subjects of the examinations for the B.Sc. (Engineering) degree that a London graduate in this subject will undoubtedly possess, at the time he graduates, a sound and thorough knowledge of the theory of engineering. To attain to the required standard will usually require three years of steady work at a day technical college at least. When the student is not able to attend a day course of study, but has to attend evening classes and prepare himself in his spare time, five years is perhaps the minimum time required, except for one of outstanding intellectual ability.

A reference to the subjects of the examinations shows at once that, with the possible exception of mathematics, hardly one of these subjects in the intermediate or final examinations can be said to have any cultural value. The consequence is that the foundation of a liberal education which was laid while the student was at school, preparing for the matriculation examination, may be entirely forgotten, and the intellect forced for a lengthy period into the restricted groove of purely technical studies. The graduate in engineering who possesses a knowledge of engineering technology which is unquestionable may, therefore, be thoroughly ill-educated, ignorant of the history or literature of even his own country, and of the elements of social science.

It seems, unfortunately, to be a fact that, in the popular estimation, engineers are considered to be deficient in culture as compared with members of other professions which require at least as arduous a technical training. It also seems a fact that the attitude of engineers to-

wards social and industrial questions is generally considered unenlightened and unsympathetic. This may be due, in no small degree, to the excessively narrow character of the conventional training of an engineer.

While the qualifying examination for admission to corporate membership of an engineering institution may rightly be of a purely technical character, it hardly seems fitting that the holder of a degree in one of the premier universities may have reached no higher a standard of general education than is covered by the meagre requirements of the London matriculation examination.

Let us suppose that, in place of one of the subjects in the intermediate and final examinations for an engineering degree, a candidate was obliged to offer two subjects chosen from such a group as modern languages, modern history, industrial history, economics, and mercantile law.

The standard required in these subjects might be such that the time required for preparation of two of them was approximately equal to that required for the single subject which they displaced. The student who passed the final examination in such a form would certainly not have so wide a knowledge of the theory of engineering as is required under the existing syllabus. He would not, however, necessarily be a less competent engineer in point of technical knowledge, but he would, without question, be an incomparably better educated man. The business of most engineers is not confined within the narrow groove of technical problems. The competent engineer should be an educated man as well as a skilled technician, and the benefit derived from an early study in the field usually known as the humanities would far outweigh the slight loss curtailed by the restriction of the purely technical learning.

The higher degrees in engineering of the University of London are three in number: Master of Science, Doctor of Philosophy, and Doctor of Science. Of these Doctor of Science is the senior degree. It has a high reputation, is only awarded after one of the other intermediate degrees has been obtained, and is out of the reach of all but those specially talented. It appears, implicitly, from a reading of the University Regulations that actual practice in the profession of engineering is necessary for the obtaining of the D.Sc. (Engineering) degree.

The degree of Doctor of Philosophy, Ph.D. (Engineering), is considered normally to be awarded on the results of original research embodied in a thesis of suitable literary form. It is thus practically out of the reach of all but those able to engage in such research. As a post-graduate degree, it stands well within the range of a capable man who is able to continue attendance as an internal student at a University College for two or three years after graduation. The standard required is high, and the possession of the degree indicates, not only the capacity for experimental research, but also the ability to co-ordinate results with theory, and to compose a thesis which represents a real contribution to scientific knowledge. The anomaly regarding this degree seems to be that it can be obtained as the result of an investigation in a relatively narrow field, without any practical experience in the profession of engineering. It is therefore possible for a young and intellectually brilliant man to hold a Doctor's degree in engineering without being an engineer, in the usually and naturally accepted sense of the word.

The remaining higher degree in engineering, the M.Sc., is considered inferior to the junior doctorate. It is one which is well within the reach of the average student who, having graduated, can spend a further period of two or three years at a technical college as an internal student. The position with regard to the external student, who has obtained his bachelor's degree by private study, and is not able to pursue a regular course of study at an engineering college, is not so straightforward. The Regulations of the University of London for the external M.Sc. degree stipulate that, at least twelve months before the student presents himself for examination, the course of study proposed shall be approved by the University. The student is required to prepare an exact syllabus, which indicates both the scope and also the degree of advancement he aims at. The actual examination consists of a dissertation, with written, oral, and practical tests. The difficulty with regard to the external student who desires to study for the M.Sc. degree is the total lack of information as to the scope or standard required by the University, and this difficulty is very serious for those who, whilst being desirous of studying privately, are not able to attend an engineering college. The difficulty with regard to external M.Sc. degrees is sufficiently indicated by the very small number of these degrees which are conferred; only one appears in the current issue of the University Calendar. It would appear, on general grounds, that practical experience in the profession of engineering ought to be a necessary qualification for a master's degree, since, without this experience, no one can rightly be called an engineer. Actually, however, the attainment of practical experience, with the corresponding inability to pursue regular courses of study, appears to operate as a disqualification.

# Trade and Advertising.

### A Convention at Hastings in June.

We invite all electrical and allied manufacturers and traders to take note of the programme of the sixth annual Convention of the Advertising Association, Inc., which is to take place from June 21st to 25th at Hastings.

Without discussing the serious problem of unemployment and the fears of some regarding the future, we may say that "Increasing Trade by Advertising," the theme of the Convention, is particularly apposite to the present national trade situation.

The full co-operation of traders is especially sought in promoting the success of an Industrial Press Session, which is being organised by the Trade and Technical Section of the Periodical Trade Press and Weekly Newspaper Proprietors' Association. This session will take place at the Royal Victoria Hotel, Hastings, on the afternoon of Tuesday, June 24th, and it will be preceded by luncheon. Those intending to be present—and the invitation is open to all businesses interested in electrical and allied publicity—will be able to journey down from London by a mid-morning special train and return in the early evening. We shall be pleased to forward details of the arrangements if communications are addressed to the Electrical Review, 4, Ludgate Hill, E.C.4.

Every endeavour is being made to ensure that the session shall be a credit to the trade and technical Press, and to make it understood what a substantial place journals of this class occupy in promoting new and maintaining existing trade connections, both at home and abroad. In certain trades there already obtains a fairly correct appreciation of the value rendered to them by their representative organs, but there are some directions in which the subject of the trade journal and its incessant business-promoting operations seems to be poorly understood.

The food that will be provided for consumption in the course of the session will be of an unquestionably high order. Professor Henry Clay, Economic Adviser to the Securities Management Trust, and Professor of Social Economics in the University of Manchester, will lead off with an address on "British Industry's Message to the World," and it is contemplated that his remarks alone will be well worthy of a special visit. He will be followed by Mr. Holbrook Jackson, Editorial Director of the National Trade Press, Ltd., whose topic is "The Voice of Industry—The Trade Press." Mr. C. Pinkham, manager of the extensive publicity organisation of the General Electric Co., Ltd., will speak on "The Service Expected from a Trade Journal," and Mr. P. Best, Managing Director of Shoolbred's, will review "The Trade Journal as a Link Between the Manufacturer and Distributor."

# Business and Industrial Notes.

**The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments, Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations, and Failures.**

## Works Welfare Schemes.

A useful text-book has just been published by the Industrial Welfare Society, 51, Palace Street, Westminster, S.W.1. While this is entitled "The Introduction of a Works Welfare Scheme," it is really a complete guide to welfare work in many directions. The brochure, states the foreword, has been prepared for the purpose of showing that most welfare activities entail little or no cost and that they may be safely and advantageously introduced into firms of any size or circumstance. There are six chapters and an appendix. The first chapter bears the general heading "Thrift," and deals with such matters as National Savings schemes, holiday and benevolent funds, &c. "Health" forms the subject of the next section and this covers accident prevention, personal hygiene, working conditions, and allied matters. In the third chapter, "Recreation," the formation of athletic and social clubs, musical and dramatic societies, dances, &c., are discussed briefly. Chapter IV treats of the educational aspect of welfare work and deals with methods of encouraging workers to attend courses of study, the formation of debating societies, works visits, works libraries, &c. Co-operation between the management and the workers by means of works committees and suggestion schemes is treated in the next chapter. The cost of welfare schemes is discussed in the final section, and some figures given by member firms of the Society are quoted as examples. The appendix is devoted to rules for the conduct of savings clubs, holiday funds, and other schemes mentioned in the body of the brochure.

## Irish Free State Electrical Imports.

The imports of electrical goods, excluding machinery, into the Irish Free State during March last amounted to £47,060, bringing up the total for the first three months of the year to £138,557, as compared with £150,658 in the corresponding period of 1929.

## Russian Instrument Imports.

The imports of "electrotechnical and precision instruments" into Soviet Russia during the twelve months ended with September last attained a value of 49,988,000 roubles, as compared with 65,136,000 roubles in the corresponding period of 1927-28.

## Legal.

OXFORD CORPORATION *v.* OXFORD ELECTRIC CO., LTD.—The Court of Appeal, consisting of the Master of the Rolls and Lords Justices Lawrence and Romer, on Tuesday last again had this action before it, on the appeal of the defendant company from the judgment of Mr. Justice Bennett in the Chancery Division. The appeal came before the Court three weeks ago but was ordered to stand over in view of a probable settlement of the whole of the litigation between the parties. The action was brought by the plaintiffs to determine the construction of a purchase clause in an Act of Parliament under which the plaintiffs gave the defendants notice to purchase their undertaking. Mr. Justice Bennett made a declaration as to the construction of the purchase clause and referred other matters to a special Referee.

Mr. TYLDESLEY JONES, K.C., for the Corporation, now stated that they had now made the defendants a definite offer with a view to settling the matter. He (Counsel) suggested that a further adjournment of the hearing of the appeal should be directed.

Mr. CRAIG-HENDERSON, K.C., for the defendants, supported this suggestion.

In the result the Master of the Rolls said that the case would be put on the list "to be mentioned" on the first day of next term.

## The United States Radio Merger.

It is reported that the United States Government has commenced an action to test the legality of the radio patent agreements recently entered into by the Radio Corporation of America, the General Electric Company of America, the Westinghouse Company, the American Telephone and Telegraph Co., and other United States concerns.

## A Holophane Conference.

On May 13th Holophane, Ltd., called a conference of lighting contractors at its headquarters, Elverton Street, Vincent Square, S.W.1. After an address of welcome by Mr. H. Hepworth Thompson, managing director of the company, a paper on the company's sales policy was read by Mr. W. T. Dean. Subsequently lectures and demonstrations upon various applications of Holophane lighting were given. Among these were a lecture on "The Scientific Basis of Holophane Lighting" by Mr. E. Stroud; a description of the manufacture of Holophane glass by Dr. S. English; notes on the practical application of Holophane by Mr. Tye, and a discourse on the scientific illumination of the kinema and theatre stage and the employment of coloured lighting in the auditorium by Mr. R. Gillespie Williams. Some remarkable effects were demonstrated by the lecturer with the aid of Holophane colour-lighting equipment.

## Local Exhibition.

COLWYN BAY.—At the Imperial Hotel, on May 7th to 17th there was arranged a display, with demonstrations, of a representative range of electrical apparatus and appliances manufactured by the General Electric Co., Ltd. The attendance of visitors was very encouraging. It will be seen from the photograph reproduced herewith that the classified exhibits

**A Display of G.E.C. Products.**

covered a very wide field of application in lighting, heating, cooking, and cleaning, while those interested in local works, factories, &c., found much to engage their attention in electrical apparatus designed to increase output and effect improvements in lighting, ventilation, and cleanliness. This travelling exhibition is the first of many which have been arranged to visit various parts of the country.

## An Indian Electrical Contractors' Association.

A body has recently been organised in Bombay (Canada Buildings, Home Street, Fort), with the title of the Electrical Contractors' Association, to promote and protect the trade and interests of electrical contractors in the Bombay district.

## Fuse Service.

An inexpensive means of improving the relations between consumers and suppliers of electricity has been brought to our notice by Mr. George Humphrey, Wimbledon. It consists of a small card (5 in. by 1¼ in.) upon which is mounted a supply of 5-A and 10-A tinned-copper fuse wire. Brief instructions for the renewal of a fuse are given and the card is over-printed with the name of a supply company. The sole distributors of the device are WHOLESALE ELECTRIC, LTD., 37, Vauxhall Bridge Road, S.W.1.

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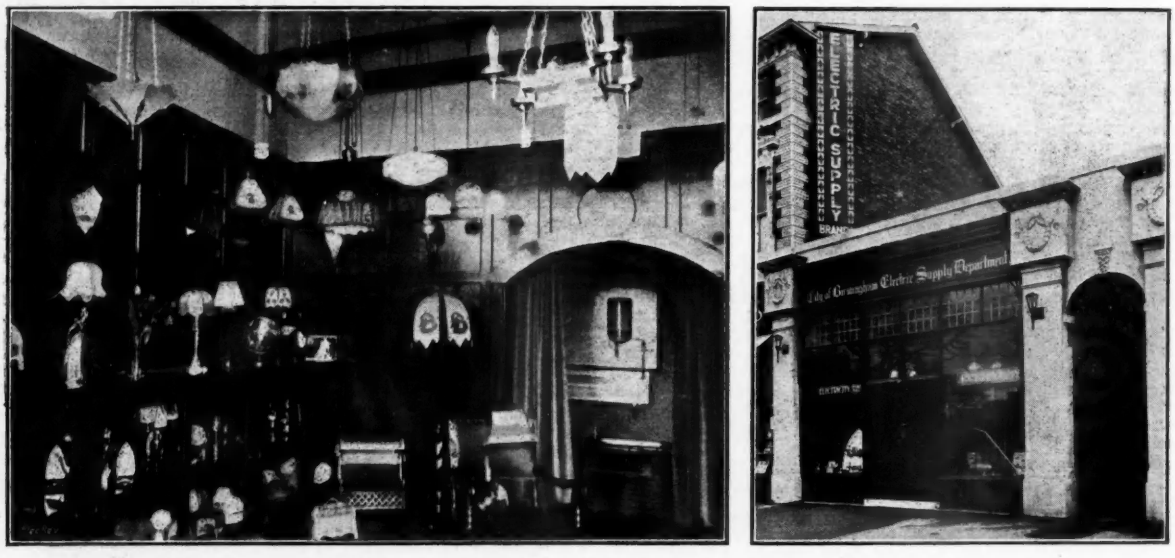
## Overseas Markets for Batteries.

Confidential reports on the markets for primary and secondary batteries in Belgium, Chile, and Greece have been prepared by representatives of the Department of Overseas Trade in those countries. Copies of the reports can be obtained by United Kingdom firms from the Department's offices, 35, Old Queen Street, S.W.1.

## A New Birmingham Showroom.

A new branch showroom has been opened by the Birmingham Electric Supply Department, at 23, Lordswood Road, Harborne. It is situated in a new shopping centre of this rapidly-growing suburb. The exterior has a smart and attractive appearance. the initial displays being devoted in one window to vacuum cleaners, and in the other to irons, bowl fires. and small appliances. A large vertical illuminated sign is placed over the shop and can be seen some distance away. Two bracket fittings finished in bronze are distinctive features of the outside. Inside, the walls are oak panelled, and there is a large showcase running the length of the shop on one side, which contains a selection of all kinds of small appliances, irons, hair-dryers, kettles, pans, coffee percolators, &c., and on the lower shelf, shades. Care has been exercised in the selection of curtains, rugs, and furniture, and the scheme of decoration generally, all of which are in harmony, and help to display the goods to better advantage. A room at the rear of the shop has been equipped so that small special demonstrations can be given from time to time. It contains a range of electric cookers, as supplied by the Department on hire, and hire-purchase terms, 10-gal. and 2-gal. water heaters fitted up over a sink for demonstration, and finally wash-boilers. Views of the new premises are reproduced herewith.




**Interior and Exterior Views of a New Birmingham Electric Supply Department Showroom.**

## Unemployment.

During the week ended May 5th the number of registered unemployed increased by 13,614, making the total 1,712,000, which compares with 1,698,386 on April 28th, and 1,132,705 on May 6th, 1929. It is estimated that on April 28th there were approximately 9,798,900 insured persons aged 16 to 64 in employment in Great Britain. This was 89,500 fewer than a month before, and 448,300 fewer than a year before.

## Winding-up Petitions.

Enterprise Manufacturing Co., Ltd.—A petition for the winding up of this company has been presented to the High Court by the Mullard Wireless Service, Co., Ltd., Spencer House, South Place, and will be heard in London on May 26th.

K.N. Electrical Products, Ltd.—A petition for the winding up of this company has been presented to the High Court by Marconi's Wireless Telegraph Co., Ltd., Marconi House, Strand, W.C.2, and will be heard in London on May 26th.

## Bankruptcy Proceedings.

Margaret K. Clements (trading as K. Raymond), wireless apparatus dealer, 27 and 28a, Lisle Street, Leicester Square, W.C.—This debtor attended before Mr. Registrar Warmington at the London Bankruptcy Court on May 14th for her public examination on a statement of affairs, in which she has returned her liabilities at £5,717, of which £5,359 is expected to rank and valued her assets at £1,009 net. In her evidence the debtor said that she acted as a director of a company until 1927, when it went into liquidation. In 1923 she commenced business as a wireless dealer in the name of K. Raymond, at 27 and 28a, Lisle Street, W.C. For the first two years she was successful, but later there were losses, owing largely to advertising expenses. She convened a private meeting of her creditors in February last, and an offer of £1,050 was made for the business as a going concern. The creditors who attended agreed to accept this offer provided that the non-attending creditors assented. Two of the creditors deposited the money and took possession of her premises, being authorised to do so, but the creditors as a whole did not agree to the sale. Since then she had incurred further liabilities. The examination was concluded.

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A. C. Dobbing and A. L. Rothery, trading as the Ripon Electrical Co., 39, Kirkgate, Ripon, Yorks., electrical engineers.—The public examination of these debtors was held on May 9th at Harrogate, when a statement of affairs was produced showing liabilities expected to rank at £810 against assets of £90, leaving a deficiency of £720. The debtor Dobbing stated that he commenced trading in February, 1928, in partnership with another. That was a failure and was dissolved in June of the same year. He continued trading, and in November was joined in partnership by Rothery. Under the partnership deed the latter was to put in £250. Dobbing did not contribute any money, but the building and goodwill were assessed at £500. He was to receive two-thirds of the profits, and Rothery one-third. The business had never paid its way owing to lack of capital. They had expected to get work when the Ripon Corporation laid certain cables, but there was a delay. Up to April last they had incurred liabilities totalling £809, and the whole of the £250 contributed by Rothery had gone. The hearing was concluded.

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J. G. Wadsworth (Nene Road Electrical Co.), electrical engineer, &c., Nene Road, Higham Ferrers.—Receiving order made May 12th on debtor's petition.

H. Gartside (H. Taylor & Co.), electrician and wireless dealer, 98, Booth Road, Waterfoot, Lancs.—Receiving order made May 13th on debtor's petition.

D. B. John (John & Bros.), electrical engineer, &c., 8, Commercial Place, Pontycymmer, Glam.—Trustee, Mr. E. Owen, 34, Park Place, Cardiff, Official Receiver. released April 2nd.

R. Blood, wireless dealer and electrician, 20, St. John's Road, Padiham, Lancs.—Mr. J. W. Carter, District Bank Chambers, Blackburn, Official Receiver, released April 2nd.

L. J. Smith, electrical, radio and cycle engineer, 16, George Street, Berkhamsted.—Last day for receiving proofs for dividend, June 3rd. Trustee, Mr. G. Mallam, 37, Cornmarket, Street, Oxford, Official Receiver.

A. Jaundrill, radio and gramophone dealer, 21, Duke Street, St. Helens.—First and final dividend of 1s. 5¾d. in the £, payable May 23rd at Official Receiver's office, Government Buildings, Victoria Street, Liverpool.

## Company Liquidations.

Symphony Gramophone & Radio Co., Ltd.—The statutory first meetings of the creditors and shareholders were held on May 14th before Mr. H. P. Naunton, Assistant Official Receiver. The winding up order was made on March 17th upon the petition of a creditor. The chairman reported that the company was registered on October 5th, 1928, with a nominal capital of £200,000 for the purpose of carrying on the business of manufacturers of and dealers in gramophones, radio-gramophones, radio receivers, electro-magnetic recording and reproducing devices, &s. An agreement was entered into for the purchase of the assets and undertakings of the Gilwern Manufacturing Co., Ltd., of Abergavenny, and of A. J. Stevens & Co. (1914), Ltd., of Wol-

verhampton, for a total consideration of £51,000, which was satisfied by the payment of £36,000 in cash and the allotment of 150,000 fully-paid shares of 2s. each. Agreements were also entered into with British Capital Trust, Ltd., for that concern to underwrite 1,750,000 shares at an underwriting commission of 3 per cent. and an overriding commission of 1 per cent., and to make the issue on behalf of the company in consideration of £18,500 which was paid in cash. A prospectus was issued offering for subscription 1,750,000 2s. shares at par. They were all taken up by the public, and with the 150,000 shares issued to the vendors, brought up the total capital issued to 1,900,000 shares. On October 17th, 1928, the Board resolved to purchase the assets and undertaking of the National Electric Co. for £25,500 which was paid in cash. Messrs. W. S. Stephenson and C. W. Hayward (directors of the Symphony Co.) each received over 32 per cent. of the consideration paid by the company, and it would be for the liquidator to consider whether there was any ground for proceeding against those two gentlemen in respect of that transaction. On the same date it was agreed to purchase for £25,000, which was paid in cash, the whole of the world's rights in certain patent inventions relating to Waterworth magazine gramophones. The purchase was duly carried out, but no magazine gramophones had been sold by the company. On December 28th, 1928, Axtell Trust, Ltd., was registered with a capital of £100 and was held out to the public as the proprietors of the business carried on in the name of the National Electric Co. The company's hire-purchase business was also latterly carried on in the name of Axtell Trust, Ltd., but the accounts of that company were all incorporated in the company's books. A preliminary draft profit and loss account and balance sheet prepared as at December 31st, 1929, disclosed a net loss of £35,706 on the trading to that date. The failure of the company was attributed to the heavy cost of the Gilwern factory, coupled with the fact that no use was made of it; to the heavy cost of the Waterworth patents in respect of which no trading was done; to unprofitable trading; and to the very poor radio season of the winter of 1929-30. The accounts showed total liabilities of £144,831, of which £87,462 was expected to rank for dividend, against assets estimated to produce £55,546. There was a deficiency of over £30,000 in assets to meet the liabilities, and thus a total deficiency of £222,482 with regard to shareholders. The creditors nominated Mr. C. I athom and Mr. H. Morgan as liquidators. The chairman stated that whoever might be appointed as liquidator the investigations into the conduct of the directors and others concerned in the company's affairs would remain in the hands of the Official Receiver, who would conduct a full and searching investigation in due course. The shareholders appointed Mr. H. Morgan as liquidator, with a committee.

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STAFFORDSHIRE ELECTRICAL ACCESSORIES CO., LTD.—Meetings are called for June 23rd at 10, Cheapside, Hanley, Stoke-on-Trent, to hear an account of the winding-up from the liquidator, Mr. D. H. Bates.

ENGINEERS' CLUB (LONDON), LTD.—Winding up order made by the High Court on May 12th.

"PHANTESTRA" (RENN'S GRAMOPHONE & WIRELESS), LTD.—Winding up order made by the High Court on May 12th.

M.E.D.A.S., LTD.—Liquidator, Mr. O. G. Sutherland, Dundee House, 15, Eastcheap, E.C.3, appointed May 2nd.

OSWESTRY ELECTRIC LIGHTING & POWER CO., LTD.—Winding up voluntarily. Liquidator, Mr. G. N. Sinclair, Prudential Chambers, Oswestry.

## Deed of Assignment.

E. PARCELL, electrical and wireless dealer, Eastcheap, Letchworth.—Particulars of claims by May 27th to the trustee, Mr. W. A. J. Osborne, 119, Finsbury Pavement, E.C.2.

## Reductions of Capital.

MARCO REFRIGERATORS (1929), LTD., & REDUCED.—A petition has been presented to the High Court for the confirmation of the reduction of the capital of the company from £200,000 to £130,000, and is now pending.

ENGLISH ELECTRIC CO., LTD., & REDUCED.—A petition has been presented to the High Court for the confirmation of the reduction of capital of the company from £5,000,000 to £3,244,472, and will be heard in London on May 26th.

## Private Arrangements.

PETO SCOTT CO., LTD., manufacturers and distributors of radio apparatus, 77, City Road, E.C., 62, High Holborn, London, W.C., and at Liverpool and Manchester. A meeting of creditors was held on May 15th, when it was stated that the position of the company was due to insufficient working capital. While the accounts for the past financial year showed a substantial profit, the directors felt justified in proposing a scheme for reconstruction. A statement of affairs showed ranking liabilities of £29,275. In addition, there was a fully secured creditor for £1,298. After allowing £1,069 for preferential claims, the net assets were £12,941 leaving a deficiency of £16,334. The directors had been in consultation with some of the principal creditors, and the financial houses concerned in the hire-purchase business with a view to a scheme being carried through, but the negotiations broke down. They then decided to call meetings of the shareholders and creditors in connection with the voluntary liquidation of the company, but a petition had been presented for compulsory liquidation. A conference of the principal creditors had decided that the hearing of the petition should be adjourned for a month, and that active steps should be taken to bring forward a proposal for the carrying on of the business and making arrangements with the creditors. It was also decided by the principal creditors that if an acceptable scheme was not brought forward, then neither the shareholders nor the creditors would oppose a winding-up order. The creditors confirmed the resolution passed by the principal creditors. The following are creditors :—

| | £ | | £ |
|---|---|---|---|
| Cossor, A. C., Ltd. ... | 286 | Brown, S. G., Ltd. ... | 119 |
| Colvern, Ltd. ... ... | 139 | Oldham Accumulator Co. ... ... ... | 220 |
| Cole, E. K., Ltd. ... | 185 | Philips Lamps, Ltd. ... | 2,231 |
| Edison Swan Electric Co., Ltd. ... ... | 432 | Rich & Bundy ... ... | 150 |
| Ede & Townsend ... | 105 | Regent Radio Supply Co. ... ... ... | 189 |
| Formo Engineering Co. | 136 | Radio Instruments, Ltd. | 106 |
| Ferranti, Ltd. ... ... | 291 | Radio Manufacturers' Association ... ... | 123 |
| General Electric Co., Ltd. ... ... ... | 687 | Standard Battery Co. | 162 |
| Garnett, Whiteley, Ltd. | 326 | St. Helens Cable and Rubber Co. ... ... | 187 |
| Jackson Bros. ... ... | 138 | Ultra Electric Co., Ltd. | 363 |
| Kolster Brandes, Ltd. | 321 | Bell, Harold, Taylor Bird & Co. ... ... | 150 |
| London Electric Wire Co. ... ... ... | 173 | Worthington, W. S. ... | 630 |
| Mullard Wireless Service Co., Ltd. ... | 747 | | |

## For Sale.

Keighley Corporation Electricity Department has for disposal two 300-kW Phœnix dynamos coupled to 460/550-V generators, and one 50-kW G.E.C. motor-generator. (See our advertisement pages to-day.)

Dumfries Corporation Electricity Department invites offers for the purchase and removal of one 66-kW two-cylinder Diesel oil engine direct coupled to a 230-V, d.c. generator, and a 3-throw single-acting boiler feed pump.

Salford Corporation Electricity Department has for sale 10,623 second-hand lamps of various wattages, principally 200 V.

(See our advertisement pages to-day.)

## Trade Announcements.

The CURTIS MANUFACTURING CO., LTD., manufacturer of resistances and other products, of Conduit Place, Paddington, W.2, has recently received numerous calls intended for Peter Curtis (wireless apparatus work) or the British Curtis Radio. In order to avoid further confusion the company asks us to state that it has never had any connection with these businesses.

Mr. A. V. JONES informs us that he has taken over the business of the ARMATURE REPAIR CO., 28, Cross Street, Hatton Garden, E.C.1.

Messrs. MULLER & CO., (ENGLAND), LTD., have removed from 6, Southampton Buildings, Holborn, W.C.2, to 113, Farringdon Road, E.C.1.

Mr. R. M. RUSSELL, electrical engineer and contractor, late of 438, Baltic Street, Bridgeton, Glasgow, and now at River Road, Carmyle, Glasgow, asks for manufacturers' catalogues to replace others destroyed by fire.

## Book Notices.

"Machine Drawing and Design," by W. Abbott. Pp. 208; illustrated. London: Blackie & Son, Ltd. Price 7s. 6d. net.

"Publications of the U.S.A. Bureau of Standards." Index to Vol. 3 of the Journal of Research, containing Research Papers No. 77 to 128, July to December, 1929.

"The Future of Empire Trade," by J. E. Ray. Pp. vii+128. London: Sir I. Pitman & Sons, Ltd. Price 2s. net.

"Electrical Wiring and Contracting," edited by H. Marryat. Vol. V. Pp. vii+1027-1263; illustrated. London: Sir I. Pitman & Sons, Ltd. Price 6s. net.

"Industrial Electricity and Wiring," by J. A. Mayer and J. F. Wostrel. Pp. ix+469; figs. 281. Price 13s. 9d. net.

"Elements of Electricity," by A. Zeleny. Pp. xxiii+438. Price 15s. net. London: McGraw-Hill Publishing Co., Ltd.

"German-English Dictionary of Technical, Scientific and General Terms," by A. Webel. Pp. x+887. London: George Routledge & Sons, Ltd. Price 36s. net.

"The Electrical Engineers' Ballad Book." A reprint of some of the verses published in the old "Electrical Engineers' Ballad Book," which is now out of print and was issued in 1907 by Messrs. Biggs & Co. The new version is published by Croydon Cable Works, Ltd.

"Lubricating-oil Specifications." No. 2 (sixth edition) of "The Gargoyle Technical Series," which is intended primarily as a medium for the education of the salesmen of the Vacuum Oil Co., Ltd.

"The 'Standard' Four-frequency Signalling System."—Describing a new departure in switching practice by International Standard Electric Corporation, which permits the use of automatic methods of working over any type of long telephone line.

### Patent Extension Applications.

The HARLAND ENGINEERING CO., LTD., is applying for an extension of five years of the term of Patent No. 22897 of 1914 for the invention of a "System of Control for Maintaining the Relative Speeds of a Number of Electric Motors." The matter is to come before Mr. Justice Luxmoore in the Chancery Division on June 17th, and notice of opposition must be lodged at least seven days before that date.

Mr. S. G. BROWN, F.R.S., intends to apply on June 17th for a date for the hearing of a petition for the extension of the term of Patent No. 22379 of 1914 granted to him and the late Professor John Perry, F.R.S.

### Change of Address.

The offices of the *Engineer* (and of "Kempe's Engineers' Year-Book") have been moved to 28, Essex Street, Strand, W.C.2. (Telephone: Central 6565.)

### New Catalogues and Lists.

GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C.2. Folder No. D.5405 dealing with the "Magnet" electric floor polisher.

ATELIERS DE CONSTRUCTIONS ELECTRIQUES DE CHARLEROI, 56, Victoria Street, S.W.1.—A stock list for May of a.c. and d.c. motors, transformers, &c.

BRITISH INSULATED CABLES, LTD., Prescot, Lancs.—A folder dealing with "Helsby" jointing materials. Also a pamphlet (No. P.255) drawing attention to "Prescot" compound sealed service and joint boxes.

STANDARD TELEPHONES & CABLES, LTD., Columbia House, Aldwych, W.C.2.—An illustrated brochure describing the Gamewell fire alarm and police telephone system installed by the company at Liverpool.

ELECTRICAL EQUIPMENT & CARBON CO., LTD., 107/111, New Oxford Street, W.C.1.—A chart illustrating the company's clamps for overhead lines, power house purposes, and underground cables.

TRANSPORTING MACHINERY & ENGINEERING CO., LTD., 76, Victoria Street, S.W.1.—A well produced brochure giving particulars of the bi-cable ropeway, with some excellent illustrations of examples of aerial ropeways in different parts of the Empire.

Messrs. ADAM HILGER, LTD., 24, Rochester Place, Camden Road, N.W.1.—An illustrated booklet describing the company's "Steeloscopes" for the rapid estimation of metallic elements in steels.

DOMESTIC ELECTRIFICATION, LTD., Townsend House, Greycoat Place, Westminster, S.W.1.—A folder illustrating and describing eight models of "Dolphin" electric fires, with prices.

PHILIPS LAMPS, LTD., 145, Charing Cross Road, W.C.2.—A leaflet bearing an illustration of the "Phililite" fitting D.I.35—a spherical model of simple but attractive design. Priced. Also a broadsheet announcing the company's summer campaign to stimulate the sale of its all-electric radio sets.

TELEGRAPH CONDENSER CO., LTD., Wales Farm Road, North Acton, W.3.—A leaflet giving particulars and revised prices of the company's "Microfu" fuses for currents of from 5 to 1,000 milliampères.

METROPOLITAN-VICKERS ELECTRICAL CO., LTD., Trafford Park, Manchester.—Descriptive Leaflet No. 39/1-1 containing full illustrated details and prices of the company's flameproof induction motors, squirrel-cage Types MS & MK and slip-ring Type MW. The types dealt with have been tested in a pentane air mixture at Sheffield University with satisfactory results.

SUN ELECTRICAL CO., LTD., 118-120, Charing Cross Road,, W.C.2.—A well illustrated list of electric fans, giving prices and brief particulars of numerous types.

BERGMANN ELECTRIC CO., LTD., 82, Victoria Street, S.W.1.—A stock list of d.c. and a.c. motors. Also an illustrated price list of fans for desks, walls, ceilings, and portholes.

Messrs. A. EMANUEL & SONS, LTD., 9-13, George Street, Manchester Square, W.1.—A net trade price list of electrical materials and accessories.

Messrs. CROMPTON PARKINSON, LTD., Guiseley, Leeds.—A leaflet drawing attention to the "K.R.N." d.c. motors.

NOX ELECTRIC LAMP CO., LTD., Clarence Road, Hunslet, Leeds.—A price list, illustrated in colour, of the company's gasfilled lamps. Also a leaflet announcing a reduction in the price of metal filament lamps.

Messrs. W. T. HENLEY'S TELEGRAPH WORKS, CO., LTD., Holborn Viaduct, E.C.1.—An illustrated brochure describing the company's distribution pillars of the sheet steel type.

Messrs. W. H. SUGDEN & CO., LTD., Glenny Road, Barking.—A stock list of new and second-hand a.c. and d.c. motors.

CONSOLIDATED PNEUMATIC TOOL CO., LTD., 170, Piccadilly, W.1.—An illustrated leaflet describing rotary electric scaling tools. Also publication No. S.P. 144 dealing with the company's garage equipment.

Messrs. SIMON-CARVES, LTD., 20, Mount Street, Manchester.—A well-produced brochure containing illustrated particulars of the company's multiple drum boilers and water-wall combustion chambers.

Messrs. HEYES & CO., LTD., Water-Heyes Electrical Works, Wigan.—The May "Wigan Review" contains, *inter alia*, brief illustrated details of a new flameproof oil-immersed t.p. thermal type circuit breaker.

### Prices of Materials.

Messrs. F. Smith & Co. report, May 20th: Copper (electrolytic bars): £61 10s., £4 10s. dec.; ditto, ditto, sheets: no change; ditto, ditto, wire rods: no change; ditto, ditto, h.c. wire: 9½d., 7/16d. dec.

Messrs. James & Shakespeare report, May 20th: No change in the price of copper bars (best selected), sheet and rod; English pig lead, £19 5s., 15s. dec.

Messrs. Edward Till & Co. report, May 20th: no change in the price of india-rubber, Para fine.

Messrs. James Forster & Co., reporting on May 17th, state that on Monday last week the market opened with a firm tone, and prices advanced on Tuesday. Afterwards the market steadily declined, and prices are now 15s. down from the top. A fair business was again transacted with consumers early in the week, but the demand has quietened down again. Arrivals have been plentiful, and there is no lack of prompt supplies. It appears that the recent demand was only temporary, and represented purchases by consumers who had been holding off the market, and in no way indicates an improvement in consumption. Should this prove to be the case, there is nothing to prevent prices going back to the £17 level, or even lower. The Board of Trade returns for April show imports of 30,924 tons and exports 6,843 tons, leaving 24,081 tons for home consumption.

## Lighting and Power Notes.

**Aberfeldy.**—ELECTRICITY SUPPLY PROMISED.—The Grampian Electricity Supply Co., Ltd., has intimated to the Town Council that the programme of extension for the current year provides for a supply of electricity for the town. The company's engineers are engaged on a survey of a suitable route.

**Argentina.**—NEW POWER STATION.—A new electric power station is being established at Vera, Province of Santa Fé, by the Sociedad Sudamericana de Servicios Publicos.

**Australia.**—NEWCASTLE (N.S.W.).—Application has been made by the City Council for sanction to a loan of £50,000 for electricity supply extensions.

**Bangor.**—MAINS EXTENSIONS SCHEMES.—The borough electrical engineer is drawing up a programme of mains extensions to be carried out at an early date, the Electricity Committee having come to the conclusion that it should be its policy to lay mains where there is a potential demand for electrical energy, irrespective of whether there is an immediate request for supply or not. The Lighting Committee has also had under consideration a proposal for a publicity campaign in connection with the development of the electricity undertaking. A sub-committee has been appointed to submit proposals for the execution of such a scheme.

**Barnard Castle.**—INAUGURATION OF SUPPLY.—The electricity supply provided by the Cleveland & Durham County Electric Power Co. by overhead mains from Bishop Auckland, was inaugurated on May 12th. A demonstration of cooking by electricity was given in the Witham Hall.

**Bradford.**—CHANGE-OVER.—The Corporation Electricity Committee has decided that the system of supply be changed over from d.c. to a.c. in certain premises at a total cost of £1,160.

TRACTION SUPPLY.—The Corporation Electricity Committee has decided to provide automatic switchgear for further sectionalising supplies for traction purposes at a cost of £1,380.

**Buckie.**—INQUIRY.—It was stated at a recent meeting of the Town Council that an inquiry regarding the Special Order applied for by the Council will be held on May 27th by Mr. Henry Nimmo, principal engineering inspector of the Electricity Commission.

**Canada.**—ELECTRICAL DEVELOPMENT IN QUEBEC.—The Southern Canada Power Company, Ltd., has secured from the Public Service Commission of the Province approval of plans and authority to begin construction of a new $6,000,000 power development at Spicer Rapids on the St. Francis River, six miles north-west of Drummondville. It is stated that the development will be carried out in four units of 12,000 h.p., to be brought into operation as and when required. Execution of the development will necessitate the flooding of some 1,300 acres of land.

**Carlisle.**—CABLES REQUIRED.—The Corporation Electricity Committee has authorised the electrical engineer to invite tenders for the supply of cables during the ensuing year.

MAINS EXTENSIONS.—The Electricity Committee has authorised mains extensions at an estimated cost of £648, and it is to provide a supply to Carleton, at a cost of £275.

**Chichester.**—EXTENSIONS.—The City Council has decided to apply for an unemployment grant, with a view to carrying out schemes of extensions in connection with the electricity undertaking at an estimated cost of £58,016.

**Colchester.**—UNEMPLOYMENT SCHEMES.—The Corporation Electricity Supply Committee has received approval for grant purposes from the Unemployment Grants Committee to schemes for the completion of the outer h.p. ring main, and the laying of electricity lines in various parishes. Application is to be made for sanction to the borrowing of sums of £19,500 and £20,430, respectively, to cover the cost of works under the schemes. Work on both schemes will commence on June 2nd; one will take six months to complete and the other ten months.

INQUIRY.—An inquiry was held at the Town Hall, Colchester, on May 6th by Mr. F. Gordon Tucker, inspector of the Ministry of Transport, into objections to the erection of certain portions of the Corporation's h.p. line to West Mersea. Mr. R. L. H. Hiscott, the town clerk, said that the Corporation had received many requests for supply from West Mersea, and so far had been met with very helpful co-operation; objections were, however, raised in certain cases on the grounds that the poles would greatly hinder the cultivation of the land, and also reduce its value if the owners had to sell at any time. Mr. W. C. C. Hawtayne, consulting engineer to the Colchester Corporation, stated that the alternative suggested by objectors meant taking the lines across the marshes which were under water a great deal of the time. Mr. J. Fenn said his clients were not antagonistic to the Corporation scheme, but the line would pass completely through the centre of their estate. Certain deviations of the line were proposed and the inquiry was closed.

**Continental.**—RUSSIA.—The Government of White Russia, states the Tass Agency, has appropriated 17 million roubles for the construction of power stations in different parts of the Republic. It is proposed to build five new stations in flax-growing regions, each of a capacity of 17,000 kW. In 1931 work will be begun in the district of Mohilev for the building of a power station of from 60,000 to 100,000 kW. This station will burn peat, of which there is a plentiful supply in the vicinity.—*Reuter* (Minsk).

**Dumfries.**—IMPROVED STREET LIGHTING.—The Corporation Lighting Committee recommends a scheme of improved street lighting at a cost of £5,000. The Town Council is to be asked to adopt the policy of converting lamps from gas to electricity whenever an electricity supply is introduced into a street where it is not at present available.

**East Ham.**—MAINS EXTENSION.—The Corporation has received sanction to the borrowing of £24,985 for the extension of distributor cables in various streets. The Electricity Committee has passed an estimate of £2,641 for laying a feeder cable from Church Road sub-station to Brancaster Road.

NEW SUB-STATION.—The Corporation has approved the estimate submitted by the borough engineer, amounting to £1,440, for the erection of the Plashet sub-station buildings and the work is to be proceeded with.

**Eccles.**—ASSISTED WIRING SCHEME.—The borough electrical engineer has been instructed to obtain information with reference to the assisted wiring of houses, with a view to the adoption of a scheme when the new showroom is erected and equipped.

**Fylde.**—COUNCIL AGREES TO ELECTRICITY EXTENSIONS.—The Rural District Council has agreed to a scheme of the Central Electricity Board to extend the supply from the Preston power station to Fleetwood. Proposals were made to alter the positions of some of the poles for the overhead lines and to carry out as much work as possible in the winter time.

**Glasgow.**—MAINS EXTENSIONS.—The Corporation Electricity Committee recommends that distributing mains be laid at a cost of £6,832. The Corporation Housing Committee has agreed that permission be granted to the Electricity Department to install rising mains to properties in advance, on condition that the City Improvements Department will pay the cost after 50 per cent. of the tenants in each tenement have been connected.

**Hampton.**—STREET LIGHTING.—At a meeting of the Urban District Council held recently, a letter was received from the London and Home Counties Joint Electricity Authority stating that the Twickenham and Teddington Electric Supply Co., Ltd., was proposing to extend mains in Broad Lane, Hampton, and inquiring whether the Council would be prepared to discuss with the officers of the Authority the question of the lighting of streets by electricity. It was decided to interview the Authority's representatives.

**Horsham.**—YEAR'S WORKING.—The accounts of the Urban District Council electricity undertaking (engineer: Mr. F. Ffrench) for the year ended March 31st, 1929, show a total revenue of £18,772 and a working expenditure of £10,242, leaving a gross profit of £8,530. The corresponding figures for the preceding year were: Total income, £16,965; working expenses, £9,330; gross profit, £7,635. After providing for capital and other charges there was a net profit of £3,945, as compared with £3,652 in 1927-28. The capital expended during the year amounted to £17,318, of which the principal item was £12,764 for machinery. The electrical energy sold increased from 1,065,381 to 1,229,946 kWh and the maximum supply demanded from 779 to 814 kW. The average price obtained per kWh fell from 3.66d. to 3.36d. Considerable progress was made with the assisted wiring scheme, and 86 applications were dealt with during the year.

**India.**—CEYLON.—Application is being made by the Director of Electrical Undertakings at Colombo for sanction to a loan of £1,250,000 for a scheme of electrical development.

**Isle of Man.**—SUPPLY AGREEMENT APPROVED.—The Douglas Corporation has approved the draft agreement with the Electrical Development and Securities Trust, Ltd., with respect to the supply of electricity in the Island, and has referred it to the Council's legal adviser for completion.

**Japan.**—POWER STATION CONSTRUCTION.—The Tokyo Hatsuden K.K., a subsidiary of the Tokyo Dento K.K., is contemplating the erection of a 100,000-kW hydro-electric power station on the Shinano River. The work is expected to be completed in 1933 or 1934 and is a part of a scheme to develop 200,000 kW on the Shinano River.

NEW PLANT.—The Fuji No. 2 Power Co. is shortly to purchase two 12,000-kW turbo-generators.

**Kendal.**—LOAN.—The Town Council has applied for sanction to a loan of £4,604 for new plant and buildings.

**Lathom and Burscough.**—INQUIRY DECISION.—Following the inquiry held at the beginning of last month, the Electricity Commissioners have decided to grant the application of the Lancashire Electric Power Co. and to refuse that of the Lathom and Burscough Urban District Council for a Special Order to supply electricity in Lathom and Burscough, Skelmersdale, and West Lancashire.

**London.**—ST. MARYLEBONE.—The Borough Council is applying for sanction to a loan of £18,567 for the purpose of improving the public lighting in approximately 9 miles of streets. The proposal involves the substitution of 270 single- and 21 double-bracket standards for 667 converted gas standards which are used for low power electric lighting. The new standards will be equipped with modern lanterns, suspended about 23 ft. above the carriageway, each lantern holding a lamp of 750 c.p. in the single-bracket standards and 560 c.p. in the double-bracket standards.

ST. PANCRAS.—The Borough Council Electricity and Public Lighting Committee recommends the provision of l.p. mains in the district which will be supplied by the Arlington Road sub-station, at an estimated cost of £7,200. The Committee also recommends mains extensions to premises in Belmont Street, Ryland Road and Lyme Terrace, at an estimated cost of £337.

FULHAM.—The Borough Council Electricity and Lighting Committee recommends mains extensions costing £6,212. Sanction has been received to a loan of £12,500 for consumers' rental wiring installations, £10,000 for mains extensions, and £7,500 for domestic apparatus to be let out on hire.

SHOREDITCH.—The Borough Council Electricity Committee recommends the following revision of the maximum demand tariff for power:—£1 per quarter per kW of maximum demand, plus ½d. per kWh consumed; where the load factor is 40 per cent. and above, the "unit" charge is to be ¼d. The Electricity Committee also recommends the expenditure of £20,000 on free wiring installations.

**Manchester.**—PROGRESS DURING MARCH.—During the month of March the Corporation electricity undertaking showed an increase of 13,117 kW in connections, bringing the total up to 424,613 kW. Applications received for supply (including additional supplies) totalled 1,248, and represented a total of 2,865 kW. The number of hired cookers connected increased by 95, making a total of 6,114 on circuit. Applications for the hire of cookers numbered 119. Four new sub-stations were put into commission and additional plant installed at two existing sub-stations. The change-over from d.c. to a.c. had been completed in the cases of 10,460 consumers up to April 9th, while sanction had been given and work was in progress involving 532 consumers.

**Portsmouth.**—SUB-STATIONS.—The Corporation Electricity Committee has received sanction to a loan of £2,337 for sub-stations.

**Rawtenstall.**—MAINS EXTENSIONS.—The Town Council has decided to apply for sanction to a loan of £20,000 for mains extensions.

**St. Helens.**—POWER STATION EXTENSIONS.—The Town Council has received sanction to extend the generating station by the installation of a 12,500-kW turbo-alternator set, together with a cooling tower and other ancillary works, at a cost of £48,150. Sanction for a loan to this amount has been applied for.

**South Africa.**—BLOEMFONTEIN.—An extension to the municipal power station is to be made at a cost of £30,000.

PORTERVILLE.—Mr. C. E. van Breda, consulting engineer, of Worcester, Cape Province, has been commissioned by the Porterville Town Council to prepare plans and specifications for an electricity scheme for the district.

**Special Orders.**—The Electricity Commissioners have submitted to the Minister of Transport for confirmation Special Orders made by them authorising the Wigan Corporation to supply electricity in the urban districts of Standish-with-Langtree and Upholland and part of the rural district of Wigan, and the Darlington Corporation to supply electricity in part of the rural district of Darlington.

**Sutton Coldfield.**—CHANGE OF FREQUENCY.—At a recent meeting of the Town Council, it was reported that a scheme had been prepared by the electrical engineer for changing the frequency from 25 to 50 cycles. The estimated cost was £10,740, and the scheme had been conditionally approved by the Central Electricity Board's engineers.

**Whitchurch.**—ELECTRICITY SUPPLY THIS YEAR.—At a meeting of the Urban District Council held recently, it was reported that the Electricity Distribution of North Wales and District, Ltd., had given a definite assurance that a supply of electricity would be available during the current year at a price less than the maximum of 9d. per kWh.

**Wigtown.**—SPECIAL ORDER.—The Holderness Trust, Ltd., has applied to the Electricity Commissioners for a Special Order authorising it to supply electricity in the county of Wigtown.

# Tramway and Railway Notes.

**Australia.**—MELBOURNE.—The Melbourne Tramways Board has received the approval of the Victoria Railways Standing Committee to construct a tramway extension from the intersection of Clarendon Street and City Road to the intersection of Flinders Street, at a cost of £23,486.

TRAMWAY RECONSTRUCTION.—The tramway services at Ballarat and Bendigo, Victoria, are to be reconstructed and comprehensive schemes are now being prepared.

**Barrow-in-Furness.**—YEAR'S WORKING.—The accounts of the Corporation tramway undertaking show that there has been a further loss of £10,735 for the year ended March 31st last. The income for the year was £30,523, as compared with £34,066 in the preceding year, while working expenditure decreased by £2,307. Fares were less than the previous year by £3,562 and £5,183 less than in 1927-28. The mileage run was 29,420 less than the previous year.

**Birmingham.**—TRAMCAR CAUTION LIGHTS.—The Corporation Tramways and Omnibus Committee has intimated that it wishes to fix automatic caution lights on the tramcars as soon as a suitable device can be obtained.

**Burton-upon-Trent.**—TRAMWAY ABANDONMENT.—The Minister of Transport has authorised the Corporation to abandon the tramways in a number of thoroughfares as from May 2nd, 1930.

**Continental.**—SWITZERLAND.—The Swiss Federal Railway authorities estimate that by 1940 the electric power requirements for railway traction purposes will amount to 645 million kWh per annum. In order to provide for the increased demand it has been practically decided to proceed with the establishment of a new hydro-electric power station at Etzel, the capacity of which will eventually be 135 million kWh per year. The plant in the existing stations at Rotomsee and Vernayaz is also to be extended.

**Exeter.**—RENEWAL OF TRACK.—The Corporation Tramways Committee is to renew the track from the Alphington Road railway bridge to the terminus at a cost of £3,000.

**London.**—RAILLESS CARS.—A Select Committee of the House of Lords on May 15th began consideration of a Bill promoted by the London United Tramways Co. empowering it to abandon 46 miles of tramways and to substitute railless cars on routes covering 20 miles in Twickenham, Teddington, Wimbledon, Hampton, Kingston, Surbiton, Malden, and Tolworth. The Committee was presided over by Lord Wester Wemyss. The promoters of the Bill were represented by Mr. Craig Henderson, K.C. The Bill was opposed by the Wimbledon and Kingston Corporations and the Urban District Councils of Surbiton, Mitcham, Merton and Morden, and Malden and Coombe. Mr. Craig Henderson stated that no dividend had been paid by the company on its ordinary shares since 1907 and none on its preference shares since 1914. Since 1918 road and track maintenance had cost the company £878,000. Railless cars had a greater acceleration than 'buses, were quieter and more comfortable. The first route which would be converted to railless cars would be from Tolworth to Kingston, Teddington, and Twickenham. It was stated that the Wimbledon Corporation's opposition was due to its desire to ensure the continuance of through-running to Hampton Court; the chairman suggested a conference on this point, and the Committee adjourned. Continuing his evidence on Friday last, Mr. Henderson stated that as a result of conferences held on the previous evening all opposition had been withdrawn. The promoters had agreed to insert a clause in the Bill providing that if the promoters proposed to convert to railless traction a part only of the tramway route between Kingston and Wimbledon, they should inform the local authorities, who might then make application to the Minister of Transport for an Order directing the company to convert the whole route. The chairman announced that the Committee found the preamble proved and the Bill would be allowed to proceed.

PROPOSED TUBE FOR SOUTH LONDON.—The provision of tube railways in South London is again being urged by many authorities. The *Financial News* says that a conference on the subject is to take place on the initiative of the Camberwell, Peckham and Dulwich Chamber of Commerce. All the Chambers of Commerce and kindred organisations in South London have appointed delegates to the proposed conference. The date and place of the conference have not yet been settled, but it will be held some time in June.

**Rochdale.**—TRAMWAY ABANDONMENT.—A Select Committee of the House of Commons has considered the Bill giving the Town Council authority to abandon a part of its tramway system and substitute 'buses, and has found the preamble proved.

# Telegraph and Telephone Notes.

**Australia.**—RADIO-TELEPHONY.—The Anglo-Australian telephone service, hitherto restricted in Australia to calls to and from Sydney and Melbourne, was extended to Brisbane, Queensland, on May 16th. Calls will be accepted for places in Queensland beyond Brisbane subject to preliminary tests proving successful.

A service between France and Australia was inaugurated on May 14th.—*Reuter* (Paris).

The first call between Sweden and Australia was effected on May 15th when an official of the Foreign Office at Stockholm spoke with the Swedish Consul-General in Sydney. The line was quite clear and the conversation lasted five minutes.—*Reuter* (Stockholm).

A service between all parts of Germany and Melbourne and Sydney, operated in conjunction with the Anglo-Australian service which began on April 30th, was opened to the public on May 19th.

**France.**—PARIS STRIKE.—The telephone service was resumed in some Paris districts on May 15th, on which date the telegraph service was also resumed in the Central Telegraph Office. As the result of the strike the cabinet met and decided to take measures forthwith to carry on the services and prevent a recurrence of the interruption, and to punish employés who refused to obey the order to resume work.—*Reuter* (Paris).

The one-day conflict apparently resulted from the Government's refusal to agree to the employés' union's wages demands.

**Greece.**—TELEPHONY.—The Ericsson telephone combine states that it will collaborate with the Siemens-Halske Co. in exploiting the concession for a telephone system in Greece. The Ericsson combine, which is participating in the share capital, will construct most of the local-circuit systems, while the Siemens-Halske Co. will supply the stations and apparatus. The Societa Ericsson Italiana will establish a branch office at Athens, which will supply all the circuit material, except the cables, which will be brought from Stockholm. The concession for the local system is for 38 years and that for the long-distance system 13 years.—*Reuter's Trade Service* (Stockholm).

The Siemens and Halske Company announces that the concession agreement has now been ratified. It provides for the modernisation of local networks and, after the acquisition of sites, &c., within the course of a year, 3,600 automatic connections are to be completed in Athens and The Piraeus. German, Greek, and Swedish capitalists will be interested, and the German company has also been authorised to extend inter-urban traffic; the network is to be completed in two years, at which time the networks will be taken over by a Greek company. The financing of the long-distance network will either be undertaken by the State or the German company.

**International Telephony.**—CONSULTATIVE COMMITTEE.—The International Consultative Committee for Long-distance Telephony, which has been meeting at Stockholm, concluded its sittings on May 16th. The proposals of the Congress will be examined by the Consultative Committee which will meet in Brussels next month.—*Reuter* (Stockholm).

**Java.**—RADIO-TELEPHONY.—Experimental wireless telephony between Java and Britain, *via* Amsterdam, was commenced on May 19th with a view to the establishment of a regular service.—*Reuter* (Batavia).

A service between Belgium and the Dutch East Indies was inaugurated on May 12th by the Minister of Posts and Telegraphs, who conversed with the Director-General of Public Works at Bandoeng, Java.—*Reuter* (Brussels).

**Scotland.**—ISLAND TELEGRAPHY.—The Mull undersea cable service was restored last week by H.M. telegraph cable ship *Monarch*, and in consequence the temporary wireless station at Oban was dismantled. The Lewis and Barra cable services were also restored.

**Siberia.**—AUTOMATIC TELEPHONY.—A large new automatic telephone exchange is to be established in Vladivostock to replace the old one which can no longer meet the growing needs of the city. The new exchange will not only serve Vladivostock, but the surrounding districts as far as Nikolsk Ussurisk as well.

**The Telephone Service.**—LOUGHTON EXCHANGE.—A new 1,020-line central-battery telephone exchange, manufactured by Standard Telephones and Cables, Ltd., was successfully cut-over on May 15th.

# Radio Notes.

**Atmospherics.**—TESTS.—The British Broadcasting Corporation has commenced to transmit a series of test signals in co-operation with the investigations of the Radio Research Board of the Department of Scientific and Industrial Research into the cause and nature of atmospheric disturbance due to lightning. The signals are being recorded at observation stations by means of Fultograph receiving apparatus. The test transmissions take place from the Midland regional station on Wednesdays and Saturdays at 10.30 p.m., and from the National stations at Daventry and Brookman's Park on Tuesdays at 2 p.m. and Thursdays at midnight.

**Irish Free State.**—IMPORTS.—In the course of his Budget speech in Dail Eireann on April 30th, Mr. Ernest Blythe, Minister for Finance, said that the import duty on wireless apparatus produced over £30,000, an increase of nearly £4,000 on the sum obtained in the previous year. When that tax was first imposed four years ago it was anticipated that it would produce about £20,000 per annum. It had ever since shown an upward trend, and it might now be safely stated that it was not likely in future to yield less than £30,000 per annum. When the tax was first levied it was indicated that the proceeds, together with the amount obtained from the annual licence duties, would be devoted to extending and improving the broadcasting service. When the new high-power station had been erected the whole amount would definitely be required for that purpose.

**Licences.**—BRITISH REVENUE.—It was recently stated in the House of Commons that the gross revenue received from wireless licences during the twelve months ended April 30th, 1930, was about £1,550,000. The corresponding figure for the previous year was about £1,370,000 and for 1924 about £500,000.

GERMANY.—On April 1st, 1930, the number of licences was 3,238,396, an increase of 171,714, or 5.6 per cent., since January 1st.

AUSTRIA.—On March 15th the number of listeners' licences was 387,065, of which 244,905 were in Vienna.

DENMARK.—The number of licences reached at the end of March, 1930, a total of 346,592, or 9.97 per cent. of the population. At the end of March, 1929, the corresponding figures were 258,000 licences and 7.37 per cent. Included in those figures is the number of licences issued free to the blind, cripples, and persons suffering from chronic diseases, which, at the end of March, 1930, amounted to 6,500, says *World-Radio*. The past licence year, as such, brought on increase of about 88,000 licences, or 34 per cent.

**Tramway Interference.**—OLDHAM.—At the Corporation Tramways Committee, the general manager recently reported that he had carefully considered representations which had been made with reference to interference with reception alleged to be due to the running of tramcars and submitted his observations thereon. After discussing the matter the Committee was unable to see its way to take any action at present.

**United States.**—"RADIO TRUST."—The Government has charged the alleged "radio trust" with violating the Sherman anti-trust law. The Department of Justice has filed a suit against seven corporations (Radio, General Motors, General Electric, American Telephone and Telegraph, Westinghouse Electric, Western Electric, R.C.A., and Victor companies and other subsidiaries of the Radio Corporation) the joint assets of which are more than £1,000,000,000. The Government's complaint is that by the pooling of important patents these companies control radio business and its future development. The petition, filed in Wilmington, Delaware, further states: "Competition among them has ceased and no outsider can obtain a licence except on terms jointly prescribed by the chief defendants."

**U.S.A.**—UNLICENSED TRANSMITTER.—Mr. George W. Fellowes, an Englishman, has been convicted at St. Louis of operating an unlicensed wireless transmitting station at his home, sentenced to a year's imprisonment, and paroled for deportation to England as an undesirable alien, says the *Evening News*. He is the first person to be convicted under the Federal Wireless Act of illegally operating a short-wave station.

# Contract Information.

**When "Contracts Open" are advertised in our "Official Notice" pages, the date of the ELECTRICAL REVIEW containing the advertisement is given in parentheses below.**

## Contracts Open.

**Australia.**—MELBOURNE.—July 30th. Victorian Railway Commissioners. Turbo-alternators, condensing plant, and control gear. (B.X. 6355.)*

July 8th. Posts and Telegraphs Department. Telephonists' telephones. (B.X. 6352.)* Telephone generators. (B.X. 6376.)*

June 17th. Indicators. (B.X. 6333.)*

July 9th. City Council. Supply of totally-enclosed metal-clad switchgear. (B.X. 6401.)*

June 11th. Supply and delivery of paper-insulated, lead-sheathed cables suitable for use on a 3-phase, 50-cycle system at presures of 6,600 and 420 V.

June 18th. Supply, delivery, and installation of automatic electric signals for traffic control. (B.X. 6421).

**Cradley Heath.**—May 31st. Upper Stour Valley Main Sewerage Board. Treble-ram pump, capable of delivering 15,000 gals. per hour, electric motor and automatic control gear, with accessories. Particulars from the engineer, Mr. C. P. Deeley, 13, Church Street, Stourbridge (returnable deposit of £1 1s.). Tenders to Mr. G. Green, clerk to the Board.

**Dartford.**—May 24th. Urban District Council. Supply of l.p. cable. (May 16th.)

**Dundee.**—June 12th. Electricity Department. Supply and laying of approximately 655 ft. 42-in. diameter cast-iron spigot and faucet piping. (May 9th.)

**East Grinstead.**—May 27th. Urban District Council. Supply, delivery, and erection of 320-kVA alternator and switchgear, a 200-kW reversible rotary, with transformers and switchgear, and a Diesel engine. (May 9th.)

**East Ham.**—June 18th. Education Committee. Installation of electric lighting at the Monega and Sandringham schools. (See this issue.)

**Egypt.**—CAIRO.—August 17th. Mechanical Department, Ministry of Public Works. Supply and erection of fifteen electric pumping stations, with pumps, motors, switchgear, &c. Specifications, &c. (deposit £10 5s.) from the chief inspecting engineer, Egyptian Government, 41, Tothill Street, S.W.1. Tenders to the Director-General, Mechanical and Electrical Department, Ministry of Public Works, Cairo.

**Farnworth (near Bolton).**—May 31st. Electricity Department. Supply of l.p. cables. (May 16th.)

**Glasgow.**—June 9th. Electricity Department. Supply of l.p. paper insulated, one, two, three, and four core, and e.h.p. cables, small indiarubber cables and flexibles, electric cookers, meters and electric kettles during the year ending May 31st, 1931. (See this issue.)

**Gloucester.**—City Electricity Committee. Supply of cooking apparatus for hire-purchase scheme. (May 16th.)

**Harrogate.**—May 26th. Cooling reservoir, &c., at Corporation electricity works. Tenders to Mr. C. E. River, borough engineer and surveyor, Municipal Offices.

**Hull.**—May 27th. Telephone Committee. Supply of three 50-line common battery private branch exchange switchboards. (May 9th.)

**India.**—June 23rd. India Store Department. Supply, delivery, and erection of 11,000- and 400-V a.c. and 220-V d.c. switchgear, power and control cables, &c., for Shanan power station. (May 16th.)

**Irish Free State.**—DUBLIN.—City Commissioners. Supply of electric lanterns for street lamps for the year ending March 31st, 1931. Superintendent of Public Lighting, Tara Street (deposit 5s.).

**Ivory Coast.**—May 31st. Establishment, for the Government, of a central electric power station and a distribution system in the town of Abidjan, under a fifty years' concession. Particulars from the Agence Economique de l'Afrique Occidentale Francaise, 159, Boulevard Haussmann, Paris.

**Liverpool.**—June 6th. Corporation. Installation of an automatic telephone exchange. (May 16th.)

June 2nd. Corporation Electricity Department. Supply of 41 motor-generator sets suitable for operation on a 400-V, 3-phase, 50-cycle supply, to give a d.c. output of 80 A at 70 V. (See this issue.)

**London.**—Central Electricity Board.—June 11th. Supply, delivery, and erection of 33-kV transformers for the South-East England Electricity Scheme, 1927. (May 16th.)

June 19th. Supply, delivery, and laying of 33-kV and other cables for the Central England Electricity Scheme, 1928. (See this issue.)

June 11th. Construction of site works, foundation works and buildings in the area of the North-West England and North Wales Electricity Scheme, 1928. (See this issue.)

June 23rd. Supply, delivery, and erection of 66,000-V and other cables for the Mid-East England Electricity Scheme, 1929. (See this issue.)

London County Council.—May 26th. Supply, laying, jointing and connecting up cables, &c., at Blackwall Tunnel in connection with the installation of new ventilating plant. (May 9th.)

**Manchester.**—May 24th. Waterworks Committee. Supply, delivery, and erection at Haweswater, Westmorland, of two rotary balancers, d.c. switchgear, cables, wiring, &c. Only complete tenders will be considered. Specification (deposit £2 2s.) and form of tender from the engineer, Waterworks Department, Town Hall, Manchester.

**New Zealand.**—Wellington.—June 24th. Public Works Department. Outdoor steelwork and 110-kV switchgear for the Waitaki power scheme. (B.X. 6238.)*

July 29th. Auxiliary turbines and generating sets. (B.X. 6356.)*

August 19th. Supply and delivery of three single-phase transformers for the Penrose sub-station. (B.X. 6427.)

June 25th. Posts and Telegraph Department. 100,000 3½-in. lead clips, 30,000 2-in. ditto, &c. (B.X. 6375.)*

July 16th. Government Railways. Four 30-cwt. overhead electric cranes for new goods sheds. (A.X. 9442.)*

Auckland.—June 10th. Harbour Board. Submarine cable. (B.X. 6354.)*

**Northern Ireland.**—Belfast.—June 4th. Belfast City and District Water Commissioners. Supply, delivery, and erection at the Oldpark works of electrically-operated pumping plant. Specifications, &c., from Mr. W. I. Quinn, secretary, Water Office, Belfast (returnable deposit of £1).

**Nottingham.**—June 17th. Electricity Department. Supply of general stores for 12 months commencing July 1st, 1930. (See this issue.)

**Ogmore and Garw.**—May 30th. Electricity Department. Supply, delivery, erection and connecting up of 11,000-V overhead lines, together with interconnecting cables. (May 9th.)

**Portadown.**—May 31st. Urban District Council. Supply, erection, and fixing of eight sets of electric motors and centrifugal pumps, with automatic switchgear. Specifications, &c., from Taylor & Wallin, 1, Saville Place, Newcastle upon-Tyne (returnable deposit of £10). Tenders to Mr. H. Sewell, town clerk, Portadown.

**South Africa.**—Capetown.—June 4th. Electricity Department. Heavy-current d.c. testing motor-generator set. (B.X. 6341.)*

June 25th. Supply of single-phase transformers. (B.X. 6378.)*

Johannesburg.—June 12th. S.A. Railways and Harbours. 2,000-V switch units and l.p. switchboards. (B.X. 6365.)*

June 19th. Supply and delivery of metal-clad 2,000-V switchboard for sub-station at Bloemfontein workshops. (B.X. 6402.)*

**West Hartlepool.**—Corporation. Supply of 230-V, 2½- or 5-amp. d.c. slot meters. (May 16th.)

**Wolverhampton.**—June 4th. West Midlands Joint Electricity Authority. Supply, delivery, and erection at Ironbridge power station of works supply sub-station, 3,300-V and 400-V metal-clad switchgear; and storage battery equipment, comprising emergency stand-by lighting storage battery, 15-kW motor-generator set, battery, trickle-charger, milking booster and spare parts. (May 9th.)

**Stockton-on-Tees.**—June 2nd. Electricity Department. Supply of paper-insulated cables. (See this issue.)

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.

# Contracts Closed.

**Glasgow.**—Corporation Electricity Committee. Recommended :—

Eighteen 400-kVA transformers.—Metropolitan-Vickers Electrical Co., Ltd.; Bruce Peebles & Co., Ltd.

Four 200-kVA transformers.—Brush Electrical Engineering Co., Ltd.

Municipal Transport Committee. Recommended :—

Street tramway poles.—Stewarts & Lloyds, Ltd.

Air compressor.—Reavell & Co.

"ECO" gearing for destination boxes.—W. C. Yuille and Co.

**Irish Free State.**—Dublin.—Electricity Supply Board. Accepted :—

Dismantling of the generating plant at the Pigeon House power station.—W. E. Fischer, Ltd.

**Liverpool.**—Mersey Docks and Harbour Board.—Accepted : Electric cables.—Liverpool Electric Cable Co., Ltd.

**London.**—London County Council.—

Supply of electric lamps.—Siemens Electric Lamps and Supplies, Ltd.

Highways Committee. Supply of h.p. and l.p. cables, and the building up of existing cables, &c., for the tramway service :—

| | £ |
|---|---|
| Standard Telephones and Cables, Ltd. (Accepted) ... ... ... ... ... | 46,726 |
| Johnson & Phillips, Ltd. ... ... ... | 48,233 |
| Callender's Cable & Construction Co., Ltd. ... | 48,976 |
| W. T. Henley's Telegraph Works Co., Ltd. ... | 49,172 |
| Pirelli-General Cable Works, Ltd. ... ... | 50,528 |
| British Insulated Cables, Ltd. ... ... ... | 51,716 |
| Macintosh Cable Co., Ltd. ... ... ... ... | 51,993 |

The tender of Standard Telephones & Cables, Ltd., has been accepted subject to a reduction of the prices in the schedule to conform with the ruling price of copper at the date of acceptance. Owing to a substantial fall in the price of copper on that date the price was reduced by £4,664.

St. Pancras.—Contracts and Stores Committee. Supply of cable :—

| | £ |
|---|---|
| Metropolitan Electric Cable & Construction Co., Ltd. (Recommended) ... ... ... | 3,026 |
| Hackbridge Cable Co., Ltd. ... ... ... | 3,164 |
| Siemens Bros. & Co., Ltd. ... ... ... ... | 3,194 |
| Edison Swan Electric Co., Ltd. ... ... | 3,247 |
| Standard Telephones & Cables, Ltd. ... ... | 3,255 |
| London Electric Wire Co. & Smiths, Ltd. ... | 3,310 |
| British Insulated Cables, Ltd. ... ... ... | 3,321 |
| Pirelli-General Cable Works, Ltd. ... ... | 3,334 |
| Croydon Cable Works, Ltd. ... ... ... | 3,480 |

St. Marylebone.—Electric Supply Committee. Recommended :—

Supply of cables for 12 months.—Enfield Cable Works, Ltd.; British Insulated Cables, Ltd.; Edison Swan Cables, Ltd.

Shoreditch.—Electricity Committee. Recommended :—

Supply of cable (£5,527).—Edison Swan Cables, Ltd.

This figure is subject to a scale of increase or decrease based on the market price of copper and lead at the date of order

Battersea.—Electricity Committee. Recommended :—

Steam pipes (£4,243).—Babcock & Wilcox, Ltd.

Water pipes (£2,304).—Aiton & Co., Ltd.

Switchgear (£410).—General Electric Co., Ltd.

**Oldham.**—Tramways Committee. Accepted :—

Special trackwork.—Edgar Allen & Co., Ltd.

**Pelton.**—Durham County Education Committee. Accepted :—

Electrical installation at new Council school (£172).—F. Reid, Ferens & Co.

**Portsmouth.**—Tramways Committee. Special track work :—

| | £ |
|---|---|
| Hadfields, Ltd. (Recommended) ... ... | 2,746 |
| Titan Track Work Co., Ltd. ... ... ... | 2,985 |
| Edgar Allen & Co. ... ... ... ... ... | 2,928 |

Electricity Committee. Four 500-kV transformers :—

| | £ |
|---|---|
| Crompton Parkinson, Ltd. (Recommended) | 1,180 |
| English Electric Co., Ltd. ... ... (a) | 1,180 |
| ,, ,, ,, ... ... (b) | 1,224 |
| British Electric Transformer Co., Ltd. ... | 1,196 |
| Hackbridge Electric Construction Co., Ltd. ... | 1,200 |
| Johnson & Phillips, Ltd. ... ... ... ... | 1,328 |

**Uruguay.**—Central Uruguay Railway Co. Accepted :—

Arc welding plant.—Equipment & Engineering Co., Ltd.

**West Stanley.**—Durham County Education Committee. Accepted :—

Electric lighting and heating at Alderman Wood's secondary school (£341).—Embleton & Barker, Ltd.

# Forthcoming Events.

**Institution of Electrical Engineers.**—June 2nd to 7th. Summer meeting in Ireland.

**(Western Centre).**—May 23rd to 26th. Sedbury Park Hotel, Chepstow. Summer meeting.

**Association of Mining Electrical Engineers (South-Wales Branch).**—August 14th. Visit to the Pirelli-General Cable Works, Ltd., Southampton.

**Royal Institution.**—Friday, May 23rd. Institution, 21, Albemarle Street, W.1. 9 p.m. "Some Scientific Instrument Makers of the 18th Century." Mr. R. S. Whipple.

**Physical Society.**—Friday, May 23rd. Imperial College of Science and Technology. South Kensington, S.W.7. 3 p.m. Discussion on "Magnetism."

**Scottish Tramways and Transport Association.**—May 23rd and 24th. Atholl Place Hotel Hydro, Pitlochry. Annual conference.

**Institute of Physics.**—Tuesday, May 27th. Institution of Electrical Engineers, Savoy Place, W.C.2. 5.30 p.m. Presidential address ("The Influence of Physical Research on the Development of Wireless.") Dr. W. H. Eccles.

**Incorporated Municipal Electrical Association.**—May 26th to 31st. Eastbourne. Annual convention.

**Tramways, Light Railways and Transport Association.**—Hastings. June 11th to 13th. Annual congress.

**World Power Conference.**—Berlin. June 16th to 25th.

**Electrical Contractors' Association.**—Llandudno. June 25th to 27th. Annual convention.

# The "Electrical Review" Service Department.

INQUIRIES must be accompanied by a stamped addressed envelope.

We shall be glad to learn the names and addresses of makers of the following devices:—

"BALMAINS" luminous paint.

BONDS unit safety cells.

HARRISON pattern switch fuse, No. 13766/080.

# Notes.

## Developments at East River, U.S.A.

Boilers designed for normal individual outputs of 1,000,000 lb. per hour have been installed at the East River power station of the New York Edison Co.

It is stated in *Power* that tests have shown that an output as high as 1,250,000 lb. per hour is obtainable—enough for a station of 125,000 kW.

At the present time there are in operation in the world only five turbine units requiring more steam than the capacity of one of the East River boilers.

The condenser circulating water inlet at the East River station is located close to the outlet of one of New York's trunk sewers. Material from this finds its way into the condensers, making it particularly difficult to keep them clean. Various cleaning methods have been tried, including rubber plugs, wire brush, and water and air, none of which have proved effective.

Sand blasting cleans the condenser tubes effectively, but it also removes the tube metal. The amount of metal removed depends upon how abrasive the sand is, the amount used, and the hardness of the condenser tube. Tests in some instances have indicated a 3 per cent. loss in weight after 300 quarts of sand had been used. Pulverised-fuel ash alone did not clean as effectively as desired, but when mixed with a small amount of sand the cleaning was almost as satisfactory as with sand alone.

The mixture found best from both points of view was three parts of pulverised-fuel ash and one part of sand. One hundred cleaning operations were conducted with this mixture on a condenser tube, and it was found that the loss in weight was negligible.

To use this mixture conveniently two tanks, each about 3 ft. in diameter and 5 ft. high, were installed. The top of each tank is fitted with a hopper through which the ash and sand is charged. Three pails of sand and nine pails of ash constitute one charge. The tank is then filled with water to make a thin mixture.

Air at 100 lb. pressure is introduced through a perforated pipe in such a way as to keep the sand and ash mixture stirred up. A flap valve prevents air leaking up through the charging hopper.

At the bottom of the tank there are two connections for a one-inch hose. The end of the hose is provided with a nozzle, designed to fit the condenser tubes, and a quick-opening valve. The nozzle is held up against the tube, and the valve is opened for a few seconds, allowing a slug of water, and ash and sand to be shot through the tube.

With this equipment condenser cleaning is both rapid and effective. Three men with two nozzles working for six hours can clean a condenser containing approximately 10,000 tubes. The tank contains enough of the mixture for about half an hour's work with two nozzles in operation.

## Scattering of X-rays.

In 1923 Compton announced a theory and experimental verification of the scattering of hard X-rays by free electrons, and in a subsequent paper he considered theoretically the case of modification of radiation scattered by bound electrons in which the latter may be removed from one orbit to the other. A correspondent to *Nature* has recently observed that a part of the monochromatic X-rays in passing through carbon undergoes a change in frequency and appears on the longer wavelength side of the primary radiation. Copper $K\alpha$ radiation was allowed to pass through carbon soot and the transmitted radiation was analysed by a calcite crystal fitted up in a Sieghahn spectrograph. A current of 8 mA was passed through the X-ray tube at a peak voltage of 28 kV. In addition to the original copper $K\alpha$ radiations and other lines in the tungsten $L$-series, a new diffuse broad line of wavelength 1592 X.U. ($\nu/R=572$) appeared on the photographic plate. This new line appears to have a more or less sharp edge on the short wavelength side. The wavelength of this line was compared with those of other lines, the presence of which might be expected from the X-ray tube excited under the given condition, and was found not to coincide with any one of them. The time of exposure was varied from 8 to 14 hours in different cases and all of them showed the same effect.

The origin of this line may be explained by the fact that the copper $K\alpha$ radiation in passing through carbon loses a part of its energy equal to that of removing the electron from the $K$-shell, either to the optical level or to infinity. The frequency difference between this line and the original copper $K\alpha$ lines is 20.1 (in $\nu/R$), whereas the value of carbon $K\alpha$ is 20.4 (in $\nu/R$: Soderman, *Zeit. f Phys.*, 52).

It may be mentioned that the possibility of this type of radiation was also predicted by Kramers and Heisenberg, and it shows a certain similarity with the Raman effect in molecules.

Nickel $K\alpha$ radiation produces a similar effect on passing through carbon. Further, this effect has also been observed in the case of oxygen and nitrogen for copper $K\alpha$, nickel $K\alpha$, nickel $K\beta_1$, tungsten $L\alpha$, radiations, the measurements of which with photographs will be published in due course.

## A French Lighting Engineers' Association.

A body has lately been formed in Paris with headquarters at 4, Rue de Dome, with the title of l'Association des Ingenieurs de l'Eclairage. The objects of the new body are to establish a common centre for all lighting engineers, to act as a liaison between lighting engineers and those interested in lighting, to examine in conjunction with other existing bodies, technical and professional, questions connected with lighting, and to act as an employment bureau for lighting engineers. The Association is to hold periodical luncheons and dinners, the first of these functions having lately been held under the chairmanship of Mr. Rouland, president of the Commité Français de l'Eclairage et de Chauffage.

## Electricity in the United States.

Mr. Matthew S. Sloan, president of the New York Edison Company, says that during the present year the electrical industry in the United States will supply more than 100 billion kilowatt-hours. Approximately 60 per cent. will be used for industrial purposes; the remainder will be consumed in homes, stores, by street railways, for street lighting, and miscellaneous uses. With 70 per cent. of the homes and 75 per cent. of industry electrified, the country, so far as area is concerned, can be considered to be fairly well covered. At the same rate of progress during the next few years there will not be many homes left unelectrified; they are to be found now chiefly on farms and in isolated communities, and about 10 per cent. of them are within reach of transmission lines. In the past three years more than 250,000 farms have been reached, and electricity is used, not only in farm houses, but also increasingly for the performance of farm operations. Although it would seem that the industry's field of activity in the future will be confined to reaching the 30 and 25 per cent., respectively, of unelectrified homes and industries, in reality its job has just commenced. Lighting, which is still one of the most general applications of electricity, is only at 17 per cent. of the minimum recommended level. Approximately 20 billion kilowatt-hours of last year's output was used for lighting, yet to reach the illumination level of greatest economic advantage, the consumption for the present year will have to be approximately 151 billion kilowatt-hours. That estimate was made by the Lamp Committee of the National Electric Light Association, and the figures apply only to indoor lighting in homes, offices, factories, and other

buildings, and take no account of the lighting of streets and highways. The average consumption for domestic use of 500 kilowatt-hours, although an increase of 16 per cent. over the preceding year, is still very far short of the average of 7,800 kilowatt-hours which has been estimated to represent an economic possibility. At that rate the 20 million domestic consumers now in the United States should use 156 billion kilowatt-hours this year. These facts make it obvious that, regardless of the high standard of living in the country, electricity has so far only touched the surface of things. Electrical requirements will continue and increase indefinitely, not only in the uses for which electricity is already employed, but also in new fields. Many of those requirements are in the realms of commerce and industry. Large railway-electrification projects are under way, airway and airport lighting and highway lighting are becoming increasingly important, and farm electrification is one of the most urgent requirements. Although the industry is short of half a century in age, its most rapid expansion has been within the past decade, during which 70 per cent. of its present equipment has been constructed. In the last seven years of that time the energy output doubled. If the present rate of expansion is maintained, the output for 1937 will be double the 100 billion kilowatt-hours used this year, and plant capacity will have doubled.

## Death in a Sub-station.

An inquest on the body of Claude Phillip Shaw, aged 47, employed by the Southern Railway, was held at Camberwell by Mr. A. Douglas Cowburn, the South London Coroner. Mr. Baker, electrical supervisor to the L.C.C., sat with the Coroner.

George Arthur Hall, a shunting inspector, gave evidence of finding Shaw lying on his back, apparently dead, in the Loughborough Junction sub-station. He was wearing rubber gloves and there was an insulating test stick close by, but no part of Shaw's body was in contact with the electrical apparatus overhead.

Dr. Charles East said that death was due to electric shock. Both Shaw's arms were burned and his skull was fractured.

William Powell, attendant at the Lewisham sub-station, said that Shaw should have telephoned that everything was in order before switching on at 4.54 a.m.

Joseph Cartridge, a sub-station attendant at Victoria, the last person to whom Shaw spoke, described a telephone conversation just before 1 a.m., in which Shaw asked him to switch the current off the road. That had already been done, but it did not disconnect current from the sub-station itself, and had Shaw wished to clean the insulators he would have sent an entirely different message.

Mr. Beney, for the railway company, said that the question of staffing sub-stations had been widely considered. It was of great importance and had been the subject of discussion with two departments, including the Ministry of Transport.

Horace John Morris, a sub-station supervisor, said that it was difficult to understand why Shaw should have telephoned to Victoria asking for "the number one circuit breaker." It was a message which applied to a 660-volt circuit, and the insulators that were to be cleaned were on an 11,000-volt circuit. They had another attendant killed in exactly the same way in July last year. There were three things that Shaw should have done which for some reason he did not do. He did not agree that if a man fell asleep in a sub-station it was likely to cause danger to his life.

Mr. Gillis: "Do you agree that if two men had been on duty and one had given a wrong message his companion would have corrected him and saved his life?—I think the other man would have pointed out the error. I must agree with you there."

James Rookby Ward, the railway company's distributing engineer in the electrical department, who is responsible for the staff organisation in sub-stations, said that from the first it had been decided that only one man was necessary and the stations were designed with that end in view. He still considered that it was the best plan. It was impossible for a shock to be received if the instructions were followed.

The Coroner later said he was not satisfied that this death would necessarily have been avoided if there had been two men on duty. The fact that one man was left for so long a period, from 11 p.m. till 7 a.m., without anyone visiting him could not be regarded as satisfactory. Apart from the question of electric shock from apparatus which appeared to be adequately safeguarded, there was the possibility of a man receiving an injury or being seized with sudden illness.

## The Smoke Nuisance.

In view of the issue of the report of the Department of Scientific and Industrial Research on atmospheric pollution, abstracted elsewhere in this issue, it is of interest to learn how the subject of smoke abatement appeared to our ancestors of the seventeenth century.

A correspondent has kindly sent us a copy of the recently reissued facsimile reprint of the 1772 edition of *The Smoake of London* (the *Fumifugium*), by John Evelyn, which was originally published in 1661 "by His Majesties Command."

The famous diarist remarks upon the unfortunate circumstance that the chief city of the Empire "should wrap her stately head in clowds of smoake and sulphur" and mentions that gardens about London no longer bear fruit. The smoke nuisance in those days arose from a different cause to that which now chiefly afflicts us, being due to the presence of industrial works burning coal in London itself and Evelyn's recommendation was their removal five or six miles down the river. Evelyn attached little importance to culinary operations and domestic uses—now the leading offenders.

It may be noted that an improvement in the state of the atmosphere was found during the contemporary equivalent of a dispute in the coal fields, namely, a siege of Newcastle. The editor of the 1772 edition strikes a distinctly modern note in a suggestion that an inquiry should be held into the possibility of treating coal so as to divest it of its smoke, and that premiums should be given to successful experimenters. There is apparently nothing new in the idea of low temperature carbonisation.

The book is produced as an old Ashmolean reprint at low price. Whether for its historical technical interest or for its literary value it is well worth possessing.

## A Church Lighting Installation.

The accompanying illustration depicts the result of a lighting installation recently carried out at Nantwich Parish Church, Cheshire, by Electricity Distribution of North Wales and District, Ltd., the authorised undertakers for the district. The installation was designed by Holophane, Ltd.

**The Lighting in Nantwich Parish Church, Cheshire.**

The whole of the wiring is v.i.r. lead covered, the cables being painted to harmonise with the stonework. The principal lighting is obtained by means of 300-watt floodlighting projectors fixed in the roof. No source of illumination is visible at ordinary eye level or from the body of the church, whilst independent switching for the various parts of the church has been provided. The illumination directs attention to the particularly fine reredos and vaulted ceiling. Arrangements have also been made to drive the organ by means of an electric motor. Permission has been given by the rector, the Rev. C. W. Montgomery Bromley, M.A., to publish the illustration. The installation is in memory of the late Mr. Thomas Power, architect, Nantwich, and has been given by his widow, Mrs. Amy C. Power.

## Appointments Vacant.

Instructor in the Electrical Engineering and Physics Department at the School of Engineering and Navigation, High Street, Popular, E.14, for the L.C.C.

Plumber-jointer for the Bangor, Co. Down, Borough Council.

Chief assistant electrical engineer for the Birmingham Electric Supply Department.

Examiners of applications for patents of inventions for the Irish Free State Civil Service Commission.

Graduate assistant in electrical engineering at the Wolverhampton and Staffordshire Technical College.

Canvasser for the Radcliffe Electricity Department.

Power station superintendent for the Scarborough Electricity Department.

Lady demonstrator and showroom assistant for the Harrogate Electricity Department.

Assistant station engineer required at the power station, Royal Arsenal, Woolwich.

(See our advertisement pages to-day.)

### An Emergency Installation.

An interesting example of the facility with which electric driving can be adopted in cases of emergency is reported from Otley. About mid-day on a Friday, the 150-h.p. steam engine at a well-known works manufacturing printing machinery suffered damage beyond repair as the result of the breaking of the crank disk, fig. 1. The Yorkshire Electric Power Co. at once approached the firm, and terms of supply were quickly agreed upon. An extension of the 11,000-V mains was necessary, and also provision of a transformer and auxiliary equipment. Temporary accommodation for the latter was found inside the works, fig. 2. Cable, transformer and switchgear were rushed to the spot, and in the meantime Mr. Robinson, a local electrical contractor, was entrusted with the wiring and installation of the necessary electric motors in the works. This collaboration proceeded to such good effect that the works were ready to resume running the following Sunday evening, and what might have been a prolonged stoppage, involving serious loss of output, was reduced to the loss of one working day.

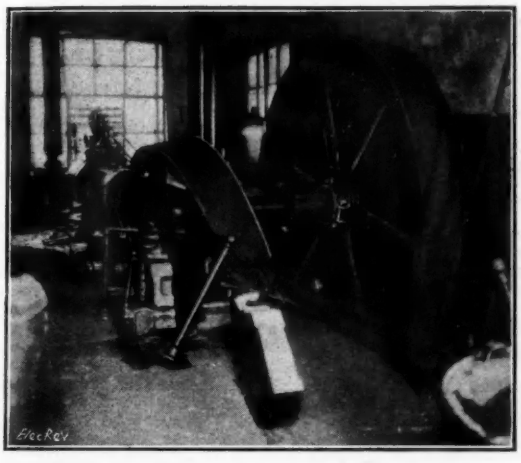


Fig. 1.—Works Engine after Breakdown.

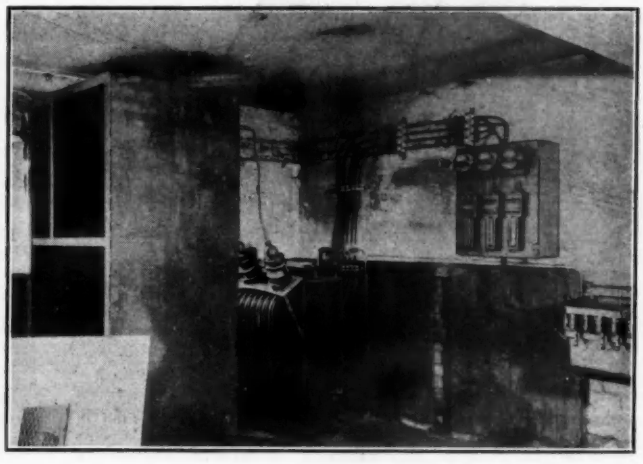


Fig. 2.—The Temporary Sub-station.

### Electricity on Board Ship.

The twin-screw motor-ship *Tuscan Star*, which recently started on her maiden voyage to South America, is the first motor-ship of the Blue Star Co., and is claimed to have the largest refrigerating capacity of any vessel afloat. Most of her electrical equipment was supplied by the General Electric Co., Ltd., and it included the main generators, nearly 60 motors, switchboards, electric cooking equipment, the whole of the switches, wall plugs and sockets, section and distribution boards, cargo connection boxes, &c., over 50 electric fans, fittings for the cabins and saloon, and for the deck and engine room, and also cabin heaters.

Direct-current at 220 volts is obtained from four 340-kW main generators of the standard compound-wound open type, running at 250 r.p.m. In addition, there is a 500-r.p.m. 15-kW emergency generator of the compound-wound, enclosed, ventilated type.

The motors for driving the compressors and other auxiliaries are all d.c. machines of the enclosed, ventilated, drip-proof, marine type. Five compressor motors are installed, two 160-h.p. and three 145-h.p. machines. Motors for driving the various pumps vary in size from 2 to 50 h.p., and two 28-h.p. motors operate the steering gear. For the large fans in the engine room, &c., a total of 17 motors are installed, ranging from 2½ to 4½ h.p.; others drive separators and workshop plant.

The refrigeration compressor motors' normal speed of 280 r.p.m. can be increased to 375 r.p.m. by shunt regulation, and reduced to 100 r.p.m. by the use of a motor-generator set which functions as a negative booster. The output of this set is 16½-kW, and gradual speed variation of the compressor motors is obtained by potentiometer regulator control of the generator fields. A special refrigerator switchboard is used in conjunction with the motor-generator, which is available for use with any one of the three compressors. After selecting by a small rotary switch the compressor whose speed it is desired to reduce, the operation of inserting the booster is carried out entirely automatically by push buttons (providing the particular motor shunt regulator is at its full field setting) without shutting down the compressor. Whilst the booster set is being used on one compressor the other two can be run at normal speed, or higher speeds by shunt regulation.

The main switchboard consists of 13 slate panels and is completely equipped with the necessary circuit breakers (with trips), shunt regulators (for the generators), indicating instruments, switches, fuses, &c. On the steering-gear motor panels indicating lamps and "Klaxon" horns are employed to give warning of any mishap affecting the steering gear.

There are also seven subsidiary switchboards, four of which control winch motors; the others consist of a harbour-service board, a galley board, and the refrigerator board referred to above.

The "Magnet" electric cooking equipment is of a comprehensive nature and includes a galley range provided with four ovens, three 12-gallon water boilers, a single-deck baking oven, two hot cupboards (6 ft. and 3 ft.), and accessories.

### A French High-voltage Testing Station.

The Société des Cables de Lyon is stated to have devoted itself for several years past to the solution of the problem of the manufacture of underground cables capable of working at between 150,000 and 200,000 volts. The French company has taken advantage of the experience gained in connection with the delivery to the Commonwealth Edison Company of Chicago of test cables at 132,000 volts to establish special manufacturing plant and a modern testing station, which has just been opened at Lyons. Three groups have been installed: (1) for tests at 700,000 volts, with the possibility of obtaining 2,000 kVA; (2) for tests at pressures up to 200,000 volts at 600 kV; and (3) for tests with direct current, up to 1,600,000 volts between two insulated terminals.

# Our Personal Column.

**Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.**

The Rotherham Town Council is recommended to appoint Mr. Cherry, general foreman at the tramway depôt, as rolling stock superintendent in the transport department, on twelve months' probation, at a salary of £300 per annum, in succession to Mr. H. B. Sharpe, who has taken up an appointment at Morecambe and Heysham.

Mr. William Grant has completed 25 years' service as general manager of the Ayr Corporation tramways, and on May 12th he was the guest of honour of the Tramway Social Club. Bailie Hutchison, convener of the Tramways Committee, presided, and during the proceedings Mr. Grant was presented with a cabinet gramophone and Mrs. Grant with a wristlet watch.

Mr. M. H. Wardle, chief assistant in the lighting department of the Liverpool Tramways and Electric Supply Department, has retired on superannuation.

We are interested to learn that Sir FELIX POLE, chairman of Associated Electrical Industries, Ltd., has been appointed, by consent of both parties, arbitrator in the dispute affecting the Broadstone cotton-spinning mills, Reddish. He was to open the proceedings on Wednesday last.

At its meeting on Tuesday last the London County Council appointed Mr. THEODORE E. THOMAS, traffic manager,

*Barratt's Photo Press* [*London.*

**Mr. T. E. Thomas, M.Inst.T.**

The new General Manager of the L.C.C. Tramways.

as general manager of the Council's tramways, in succession to Mr. J. K. Bruce, who is retiring at the end of June on account of continued ill-health. The salary is £2,000 per annum rising after four years' service by annual increments of £250 to £3,000. Mr. Thomas was born in 1882 and was educated at the Battersea Grammar School. He entered the service of the London United Tramways Co. under the late Sir Clifton Robinson in 1899, and became district engineer of the Surrey lines of that company in 1910. Later he transferred to staff of the "Underground" Group. After the absorption of the London General Omnibus Company by the group, he became commercial superintendent of the group of companies. He entered the service of the L.C.C. in 1917 as development superintendent of the Tramways Department, as the result of public advertisement, and was appointed traffic manager in 1925. Later, he was deputed to act as general manager in Mr. Bruce's absence. Mr. Thomas was awarded the gold medal of the Institute of Transport, of which he is a member, in 1927, for a paper on passenger transport. He has been a member of the council of the Tramways, Light Railways and Transport Association since 1927.

Mr. M. I. LIPMAN, engineer representative for the A.E.G. Insulation Materials Department, has relinquished his position to take a post with Messrs. E. K. Cole, Ltd., Leigh-on-Sea, as production engineer as from May 31st. His place is being taken by Mr. F. E. Chilton, A.M.I.E.E.

Major W. H. C. COATES, M.C., M.I.E.E., of 8, St. James's Square, S.W., terminated his engagement with the English Electric Co., Ltd., on May 7th. Originally in the engineering department of the Great Eastern Railway Co., Major Coates joined Siemens Brothers Dynamo Works, Ltd., in 1906, and remained in their service until 1915, when he held the appointment of general manager of their Eastern branches with headquarters at Singapore. He resigned this appointment on receiving a commission in the Royal Field Artillery, with whom he served in France, being mentioned in dispatches and receiving the Military Cross. He attained the rank of major in 1918. Joining the English Electric Co., Ltd., in 1919, he was appointed general manager for India in 1920, and held this appointment until 1923. In 1925 he proceeded to South Africa to reorganise the English Electric Co.'s business arrangements in the Union, and was managing director of its local company until recalled in 1926 to undertake a special mission to Ceylon, Malaya, and the Far East, from which he returned at the end of 1928.

Mr. V. Z. DE FERRANTI is one of those busy men who realise the value of the aeroplane in getting about the country. In the accompanying picture he is seen starting from Hollinwood last week for the opening of the new million-volt testing laboratory at Stourport of Steatite & Porcelain Products, Ltd., for which Messrs. Ferranti, Ltd., supplied transformers, and which is described in this issue. Mr. Ferranti is in the forward cockpit.

Mr. L. BRADSHAW has resigned his position as charge engineer with the Hornsey Borough Council to take up the position of shift charge engineer at South Shields. Mr. A. R. E. BAILEY, also a charge engineer at Hornsey, is taking up a similar post with the Hastings Corporation.

The Wigan Town Council has appointed Mr. NORMAN RYLANCE as traffic superintendent to the tramways department at a salary of £300 per year. Mr. Rylance has been associated with the Bolton tramways for 17 years, and has been assistant to the traffic superintendent.

The president of the Engineering Section of the British Association for the Bristol meeting in September is Sir ERNEST W. MOIR, Bt. Dr. F. E. SMITH, F.R.S., is president of the Mathematical and Physical Science Section.

The Electricity Commissioners announce that Mr. H. NIMMO, M.I.E.E., M.I.Mech.E., electrical inspector and adviser to the Government of Burma, has been appointed chief engineering inspector of the Electricity Commission as from May 15th, in succession to Colonel T. C. Ekin, M.Inst.C.E., who has retired under the age limit.

Mr. H. J. DEAN, A.M.I.E.E., managing director of Dean's Electrical and Engineering Co., Ltd., of Rotherham, has been elected chairman of the Sheffield branch of the Electrical Contractors' Association.

The Swindon Town Council has decided that the commencing salary of the borough electrical engineer shall be £700 per annum, rising by annual increments of £25 to a maximum of £900.

The Spalding Urban Council has fixed the salary of the electrical engineer at £350 per annum from April 1st last, plus £50 travelling expenses.

# Obituary.

**Mr. R. H. Selbie.**—We regret to report the death of Mr. R. H. Selbie, which occurred suddenly during a service in St. Paul's Cathedral on May 17th. Mr. Selbie had been general manager of the Metropolitan Railway Co. since 1908, and he was a director of two subsidiary estate companies. Under his direction a great deal of electrification work was carried out, and he had planned important extensions of the company's electric system. For his services to the Government during the war as Controller of Horse Transport he was awarded the C.B.E. He was 62 years of age.

**Mr. G. H. Reed.**—The death occurred on May 10th, at the age of 82 years, of Mr. George Henry Reed, engineer, of Chagford, Devon, whose enterprise resulted in the formation of the Chagford Electric Light Company in 1891.

**Dr. E. Gumlich.**—The death is reported from Berlin, at the age of 71 years, of Professor Dr. Ernst Gumlich, for many years head of the German State Physical-Technical Institute and a leading German authority on electrical measurements.

**Mr. V. Z. de Ferranti about to "take the air."**

**Wills.**—The late **Mr. Victor Falk,** a director of Falk, Stadelmann & Co., Ltd., left estate valued at £91,259 (£89,951 net personalty).

**Mr. Michael B. Field, O.B.E.,** the late managing director of Kelvin, Bottomley & Baird, Ltd., left personal estate of the net value of £10,925.

# Financial Section.

**New Companies, Returns of Share Capital, Debenture Charges, Reports of Electrical Companies, Dividend Changes, Transactions in Stocks and Shares.**

## New Companies Registered.

**K. Raymond, Ltd.**—Private company. Registered May 13th. Capital, £100 in £1 shares. Objects: To carry on the business of manufacturers of, agents for and dealers in all kinds of radio apparatus, components, spare parts and accessories and electrical apparatus, film producers, renters or exhibitors, &c. The subscribers are: A. L. Vandervelde, 6a, Seaford Street, King's Cross, W.C.1, electrical engineer; M. Hyde, 7, West Halkin Street, S.W.1, commercial agent. Solicitors: Horner & Horner, 33, Chancery Lane, W.C.2.

**Brighton Radio Circuit, Ltd.**—Private company. Registered May 14th. Capital, £100 in £1 shares. Objects: To acquire, construct and deal with wireless, land and submarine telegraphs (including telephones, &c.), and lands, works, buildings, &c., to establish and maintain radio and other stations, to carry on the business of consulting radio experts, designers and manufacturers of and dealers in generators and accumulators, radio, electrical, telephone and telegraph appliances, &c. The first directors are: J. Ellice, 54, Brompton Square, S.W.2, underwriting member of Lloyds; J. B. Sturgis, Hamsey House, Lewes, member of the Stock Exchange (both permanent). Solicitors: J. K. Nye & Donne, Brighton.

**Rees Radio, Ltd.**—Private company. Registered May 15th. Capital, £1,000 in £1 shares. Objects: To carry on the business of engineers, electricians, manufacturers of and dealers in radio apparatus, electrical, magnetic and radio-active instruments, combined television and sound-producing and reproducing instruments, gramophones, ribbon records for gramophones, combined film and record ribbons for gramophones and projection, &c. The first directors are: G. H. Rees, Westcott House, Dorking; K. L. A. Arnott, 10, Christ Church Road, East Sheen (both directors of Rees Mace Manufacturing Co., Ltd.). Registered office: 75, Kilburn Lane, W.10.

**Static Electric, Ltd.**—Private company. Registered May 14th. Capital, £500 in £1 shares. Objects: To carry on the business of electrical engineers, radio and mechanical engineers, dealers in radio sets, gramophones, &c. The directors are: R. C. Martin, 3, Belfield Road, Didsbury, Manchester; J. R. Hoult, 9, Peru Street, Higher Broughton, Manchester. Solicitor: J. L. Beech, 23, King Street, Manchester.

**William Archibald & Son (Glasgow), Ltd.**—Private company. Registered May 12th in Edinburgh. Capital, £500 in £1 shares. Objects: To carry on the business of plumbers, electricians, heating, lighting, ventilating, and sanitary engineers, &c. The directors are: R. Archibald, plumber, and W. C. Archibald, electrical engineer, both of 268, Whitehill Street, Dennistown, Glasgow. Solicitors: Thompson and Morgan, Alloa.

**"Beeantee" Illuminations, Ltd.**—Private company. Registered May 10th. Capital, £1,000 in £1 shares. Objects: To carry on the business of electrical accessories manufacturers, agents, importers and exporters, &c. The directors are: H. A. Turner, 10, Hampton Road, Leytonstone, E.11; H. Bloom, 15, Highbury Quadrant, Highbury, N.5. Registered office: Wingo House, 25, Norton Folgate, E.1.

**District Transmission Lines, Ltd.**—Private company. Registered May 10th. Capital, £100 in £1 shares. Objects: To carry on the business of electricians, electrical, mechanical, metallurgical and chemical engineers, manufacturers and contractors for the installation and supply of electrical or other force, &c. The directors are: J. Collier, Ecclerigg, Windermere; W. Vickers, 1, Grosvenor Road, Urmston. Secretary: W. Vickers.

**Radcliffe Armature Repair Co., Ltd.**—Private company. Registered May 17th. Capital, £300 in £1 shares. Objects: To carry on the business of electrical and mechanical engineers, electricians, manufacturers and repairers of, agents for and dealers in armatures, dynamos, batteries, electrical accessories, &c. The directors are: Mary E. Taylor, 4, Westbourne Avenue, Great Lever, Bolton; H. Chadwick, 14, Whitley Street, Rochdale Road, Manchester; W. E. Nicholson, 54, Hill Street, Elsecar, Barnsley; Minnie E. Nicholson, 4, Westbourne Avenue, Great Lever, Bolton. Secretary: Mary H. Taylor.

## Official Returns of Electrical Companies.

**Britain's Best Crystal, Ltd.**—Capital, £100 in £1 shares. Return dated January 14th, 1930. All shares taken up. £100 paid. Mortgages and charges, nil.

**Dulverton Electric Lighting Co., Ltd.**—Satisfaction in full on May 1st, 1930, of debenture dated June 8th, 1927, and registered June 16th, 1927, securing £1,000.

**North Wales Power Co., Ltd.**—Particulars filed of £300,000 debentures authorised May 1st, 1930, charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued.

**R. Langston Jones & Co., Ltd.**—Particulars filed of £5,000 debentures authorised May 2nd, 1930, charged on the company's property, present and future, including uncalled capital, the whole amount being now issued.

**Lustre Electric Lamps, Ltd.**—Particulars filed of £1,200 debentures authorised May 5th, 1930, charged on the company's property, present and future, including uncalled capital, the whole amount being now issued.

**William Johnson & Co. (Sheffield), Ltd.**—Capital, £2,500 in £1 shares. Return dated December 31st, 1929 (filed March 12th, 1930). 2,025 shares taken up. £1,025 paid. £1,000 considered as paid. Mortgages and charge, nil.

**H. D. Douglas & Co., Ltd.**—Capital, £1,000 in £1 shares. Return dated December 28th, 1929. Two shares taken up. £2 paid. Mortgages and charges, nil.

**Adelaide Electric Supply Co., Ltd.**—Capital, £3,000,000 in 1,750,000 preference, 750,000 preferred ordinary, and 500,000 ordinary shares of £1 each. Return dated December 5th, 1929. All shares taken up. £2,870,000 paid on the preference, preferred ordinary and 370,000 ordinary shares. £130,000 considered as paid on 130,000 ordinary shares. Mortgages and charges at date of return, £1,535,191.

**Sennybridge Electric Supply Co., Ltd.**—Capital, £1,500 in £25 shares. Return dated June 30th, 1929 (filed March 17th, 1930). 48 shares taken up. £1,200 paid. Mortgages and charges, nil.

**Johnson & Murrell Electric Co., Ltd.**—Capital, £5,000 in 1,000 preference and 4,000 ordinary shares of £1 each. Return dated December 31st, 1929. 1,000 preference and 2,200 ordinary shares taken up. £1,700 paid. £1,500 considered as paid. Mortgages and charges, nil.

**Electrodrives, Ltd.**—D. R. Evans, 29-30, King Street, Cheapside, E.C.2, ceased to act as receiver and/or manager on April 29th, 1930.

**C. Barnett, Ltd.**—F. T. Smith, 150, Southampton Row, W.C.1, was appointed receiver and/or manager on May 5th, 1930, under powers contained in debentures dated November 15th, 1928, to March 1st, 1930.

**P. Goddard & Co., Ltd.**—Two debentures dated April 25th, 1930, to secure £500 and £250 respectively, charged on the company's undertaking and property, present and future, including uncalled capital. Holders: C. Miles and P. F. Goddard, both of 98, Hampstead Road, N.W.

**Harry H. Gardam & Co., Ltd.**—Satisfaction to the extent of £8,550 on April 9th, 1930, of £28,500 debentures of second and third series authorised September 22nd, 1922, and registered October 4th, 1922. (According to the register of mortgages, the two series of debentures registered October 4th, 1922, originally secured £15,000 and bonus of £1,500 and £15,000.)

**Dorian Wireless, Ltd.**—Debenture dated May 9th, 1930, to secure all moneys (not exceeding £2,000) owing by the Halcyon Wireless Co., Ltd., to Westminster Bank, Ltd., for which the debenture holder may be liable under a deed of guarantee, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: E. L. Lumley, 39, Lombard Street, E.C.3.

**Camden Engineering Co., Ltd.**—R. C. Sheen, Capel House, New Broad Street, E.C.2, ceased to act as receiver and/or manager on May 8th, 1930.

**Hexham & District Electric Supply Co., Ltd.**—Issue on April 28th, 1930, of £1,000 debentures, part of a series already registered.

# City Notes.

## Calcutta Electric Supply Corporation, Ltd.

The annual meeting of this company was held on May 12th, Lord Meston (chairman) presiding. In presenting the report and accounts (Electrical Review, May 9th, p. 880) the chairman said that during the year under review 170,000,000 kWh were sold, as compared with 148,000,000 kWh in the preceding year. An additional 17 miles of overhead lines were erected and 58 miles of underground cable were laid. Important contracts were concluded with new power consumers, 2,848 houses were connected to the supply system, and the demand for cooking, refrigerating, &c., was encouraging. The tariff for h.p. power was reduced by approximately 10 per cent. all round. Their chief extension was the completion of the new line to Serampore, which was being developed into a ring main by cables laid across the river bed at Cossipore and higher up near Titaghar. A supply was commenced on April 20th, 1929. To meet the possibilities of an increased load by this extension, they must enlarge the Cossipore station and relieve Cossipore of a large part of the demand of the South Howrah area. To serve the Howrah side of the river, a tunnel for cables was being bored under the river at their southern station. The work would be completed by midsummer of 1931. The capacity of the southern station was being increased by a 20,000-kW turbo-generator with the necessary boiler plant. They had commenced the installation of larger converting and transforming plant in the sub-stations. They were also extending their distribution system and replacing overloaded feeders by larger ones. These developments and improvements required considerbale addition to their capital resources and they had recently issued privately 220,000 preference shares. It was hoped to issue before this time next year a substantial amount of ordinary shares which it was intended to offer to existing holders of ordinary shares. The report and accounts were adopted.

## The Swedish Ericsson Company.

The report of the Telefon a.b. L.M. Ericsson states that the works were in part overloaded in 1929, and work had to be passed to the foreign subsidiary companies in an increased measure. In the case of the Swedish works the value of the deliveries rose from 42.39 million kr. in 1928 to 49.22 millions last year, of which 26.36 millions was accounted for by the telephone factories, 5.54 millions by the cable factory at the Alvsjo, 13.52 millions by the Sieverts cable factory, and 3.79 millions by the Swedish Radio Company. The number of persons employed in the telephone factories increased during the year from 2,825 to 3,336, while for the whole of the Swedish works the augmentation was from 3,825 to 4,607. The net profits rose from 3,770,000 kr. to 7,107,000 kr., and the dividend is raised from 7 to 8 per cent. During the year work was intensively carried on in the direction of "rationalisation" both as regarded the introduction of modern machines and the adoption of improved working methods. An agreement was made with the American Bell Telephone Company with regard to joint traffic between its telephone network in North America and the Ericsson system in Mexico, while the company's interests in Argentina were materially developed. The report states that the company now owns manufacturing undertakings in 12 foreign countries. The share capital stands at 60,500,000 kr.

## Ferranti, Ltd.

At meetings held on May 16th the holders of the company's 6 per cent. cumulative and 7 per cent. preference shares approved a scheme for the rearrangement of the capital. Mr. V. Z. de Ferranti presided, and explained that the company's business had made satisfactory progress, but this had entailed large additions to buildings and plant which had been financed by the company's bankers. To pay off the banker's advances and to provide further working capital, it was proposed to issue £250,000 in the form of preference shares; there were no debentures. The proposal was to consolidate the two classes of preference shares into one class of 7 per cent. cumulative preference shares. The ordinary capital would be increased to £400,000 in 10s. shares. To effect this, £200,000 of the undivided profits would be capitalised and distributed to the ordinary shareholders as a bonus. The capital of the company would then total £900,000. The scheme has now to be approved by the Court.

## Philips' Glow Lamp Works.

The Amsterdam correspondent of the *Financial Times* reports that at the annual meeting on May 16th the chairman stated that the company had sold its interest in the General Electric Company of America at a price which considerably exceeded the purchase figure. The General Electric Company of America had retained its interest in Philips Glow Lamps, amounting to 20 per cent. of the share capital. The chairman further stated that, on account of the issue in London, liquid assets had increased by approximately £1,250,000, and that the financial position was favourable. No expansion project had been made which could not be financed by means of available funds. The board had decided to erect a factory in Australia, for which project it would be unnecessary to issue new shares.

## Brush Electrical Engineering Co., Ltd.

The accounts of this company were abstracted in our last issue, p. 924, and the annual meeting was held on May 20th. Mr. E. Garcke (chairman), who presided, said that the business of the company had not undergone any change for the worse. The general condition was satisfactory, and the financial position was strong. The reason for the decline in profits was due to the policy based on the principle that they declined to do business at a loss. During the past year the trend of competition had still further reduced the low price level that prevailed in 1928 and previous years, and they had deliberately declined to take orders which, if accepted, would have still further reduced their net profits. Mr. Garcke went on to review the general industrial conditions of the country, and said the fall in prices, trade depression, and unemployment were now all-world problems, but they were more accentuated in this country than in most other industrial countries of the world. The prominent reason for the general depression was that the productive capacity of the world had been increased enormously since the war, owing to the inclusion of women as wage-earners and other similar causes. If we in this country wished to continue to import as much as we did, we must export more. Referring to the necessity for successful collaboration between capital and labour, the chairman said that they had demonstrated in their company the considerable benefits that resulted from a co-partnership scheme. He was against the general reduction of wages because he was convinced there was no remedy that way. Under present conditions he suggested that our principles should be: (1) greater economy by elimination of waste; (2) higher efficiency by eliminatjon of inefficient machinery and methods; (3) larger output to neutralise low prices by removal of trade union restrictions; (4) better relations between all concerned in industry by adoption of schemes of co-partnership appropriate to such industry; and (5) nationally and internationally, we must revise our general outlook by taking off our personal "blinkers." The report and accounts were adopted.

## Richardsons, Westgarth & Co., Ltd.

The accounts for 1929 show a trading loss, after crediting income from investments, of £13,559, as compared with a profit of £33,741 in 1928. In addition directors' fees amounted to £1,152, and the preference share dividend for the year ended October 31st, 1929, to £21,000, making a total of £38,211. Against this a credit balance of £3,655 was brought forward, and the directors have transferred £35,000 from general reserve, resulting in a credit balance of £444 which is to be carried forward. The report refers to the almost unprecedented depression in shipping and in the related industries of shipbuilding and marine engineering. Prices have shown a further decline during the year, due to severe competition for the small amount of work available, and in consequence the total volume of work executed has been insufficient to keep all three works fully employed. The position has become so serious that the directors have been compelled to close down the Middlesbrough works to minimise loss. There was greater activity in the land department, but this was not sufficient to compensate for shortage of marine work, which constitutes the company's staple business.

## Cawnpore Electric Supply Corporation, Ltd.

Presiding at the annual meeting on May 13th, Mr. J. G. B. Stone (chairman) in presenting the report and accounts (Electrical Review, May 9th, p. 880) said that the electrical energy generated during the year amounted to over 37,000,000 kWh, and the total sold showed an increase of nearly 20 per cent. as compared with 1928. There were signs of an improvement in trade, and they had received and were discussing further contracts for the supply of power. The board had decided therefore to extend the Riverside power station, and two of the existing turbines were to be replaced by others of greater output, while a new turbo-alternator was to be added. Larger and more modern switchgear was also required. The construction of this plant was well in hand, and the first shipment was now being made. It was hoped that the new machinery would be in operation by about the end of the current year. The report and accounts were adopted.

## Ebonite Container Co., Ltd.

Presiding at the annual meeting on May 14th, Mr. E. B. Ridsdel said there was a net profit on the year's trading of £13,908. It was proposed to pay a final dividend of 5 per cent. and a bonus of 2½ per cent., making 12½ per cent., less tax, for the year. The same dividend was paid for the previous year, but this year it was paid on the increased capital of £85,000. During the current year trading conditions were not so satisfactory as last year, due to the state of world trade and political uncertainty. They were experiencing severe competition from composition products, although they were still maintaining a fair share of trade. They were also looking into and experimenting with new products, which they might be able to manufacture in their works and thereby secure additional business. Their interest in Ferguson Shiers & Co. (Failsworth), Ltd., looked very promising, and they expected very satisfactory dividends from that company. The report and accounts were adopted.

### Oriental Telephone & Electric Co., Ltd.

The accounts of this company were abstracted in our issue of May 9th, p. 879, and the annual meeting was held on May 13th. Sir A. Henry McMahon (chairman), who presided, said that the new automatic system was brought into operation on April 18th in Singapore and was working satisfactorily. The position in Mauritius was far from satisfactory. The financial position of the Colony was such that they could not look forward with confidence to any substantial improvement in the immediate future. After referring to the progress of the subsidiary and associated companies during the year under review, the chairman submitted the report and accounts, which were adopted.

### Siemens Bros. & Co., Ltd.

The report for the year ended December 31st last shows a profit of £314,465, as compared with £335,758 in 1928. The ordinary dividend is maintained at 7½ per cent. and the amount carried forward is £338,511. The report states that a larger proportion of the orders carried out has been for overseas, but to secure this work, low prices had to be accepted. The issue to Siemens & Halske, A.G., of 450,000 ordinary shares has been duly completed. Dr. H. R. Wright has joined the board of Siemens & Halske, A.G., as the company's nominee, and Dr. A. Franke of Siemens & Halske has been appointed a director of the company.

### North Somerset Electric Supply Co., Ltd.

Presiding at the recent annual meeting, Mr. H. B. Napier (chairman) said that the revenue showed an increase of over 30 per cent. on the previous year's working. During the year the Burnham and Mid-Somerset Electric Supply Companies had been taken over. The purchase of these two companies had been mainly effected by an exchange of shares, and for this reason the authorised capital of the company was increased by £50,000. Of these 50,000 shares there remained a balance of 23,016 unissued which were now being offered to shareholders on a par basis. In the near future further capital would be required. The report and accounts were adopted.

### Shanghai Electric Construction Co., Ltd.

The report for the year ended December 31st last shows a profit for the year of £170,763, to which is added £12,028 brought forward, making £182,791 available. Of this, provision for renewals absorbs £40,000, taxation £24,000, reserve £20,901, and contribution to Shanghai staff provident fund £2,049, leaving a balance of £95,840. It is proposed to pay a final dividend of 7½ per cent., making 12½ per cent. for the year, free of tax, and to carry forward £20,840. The report states that the company, as managers of the Singapore Traction Co., Ltd., participated in the profits of that company for the year ended September 30th last to the extent of £14,000. Meeting: May 28th.

### British Radio Gramophone Co., Ltd.

Speaking at the annual meeting on May 17th, Mr. W. S. Worthington (chairman) referred to the company's difficulties, and said that they had decided to abandon manufacturing altogether and concentrate on selling. Their subsidiary, the Peto Scott Co., Ltd., had had a good year's trading and it had a good future if the present difficulties could be overcome. A creditor who had presented a petition for the winding up of the Peto Scott Co. had consented to an adjournment and the directors were hopeful of formulating a scheme which the creditors would accept.

### Cammell Laird & Co., Ltd.

Although the directors' scheme for extending the term of the company's debentures was approved by the holders of the 5 per cent. stock, the holders of the 4½ per cent. stock at an adjourned meeting on May 14th did not pass the scheme. The chairman (Mr. W. L. Hichens) stated that the directors would endeavour to evolve another scheme acceptable to all the parties concerned.

### Chloride Electrical Storage Co., Ltd.

The directors recommend a final dividend of 20 per cent. on the ordinary shares, making 30 per cent. for the year, against a total dividend and bonus of 25 per cent. for 1928-29. They also propose to issue a share bonus of 100 per cent. to the ordinary shareholders. These shares will not participate in the dividend now recommended.

### Companies Struck off the Register.

The names of the undermentioned companies have been struck off the register and they are thereby dissolved:—

Associated Welding Co., Ltd.
Oxford Scientific Instrument Co., Ltd.
Regent Electrical Co., Ltd.

### Richard Johnson & Nephew, Ltd.

The net profit for the year ended March 31st last was £40,673. It is proposed to pay a dividend of 8 per cent. on the ordinary shares, leaving £16,370 to be carried forward. Meeting: May 28th.

### Power Investment Corporation, Ltd.

The accounts for the year ended March 31st last show a net profit of £5,169, as compared with £35,787 in the preceding year. A dividend of 5 per cent., less tax, is paid on the ordinary shares, and £39,746 is carried forward.

# Stocks and Shares.

TUESDAY EVENING.

CONDITIONS in the Stock Exchange markets continue to be determined in no small degree by the money market. The cheapness of money at the present time is counteracted as a Stock Exchange influence by the number of new issues which have recently been made, and which are by no means completed. The principal issue which overhangs markets for the time being is the forthcoming Reparations Loan, round which there has been a considerable amount of international squabbling. The rate of interest—5½ per cent.—was agreed some time ago, but the latest trouble has been to find the price at which investors are likely to take the loan in the various countries in which it is to be offered. So well advertised has the wrangling been that an unfortunate atmosphere is created in advance, likely to prove prejudicial to the success of the loan when it actually appears. The purely investment markets are slightly affected by this state of affairs, and the prices of some of the best-class stocks have gone back to a minor extent. Falls of ¼ lowered Central Electricity fives to 99⅝, and North-West Midland fives to 98¾. North Metropolitan Electric new debenture is ¼ down at 105¼.

### Home Railway Heaviness.

Depression has settled over Home Railway prior-charge securities. For reasons that are difficult to explain, people have been, and are, selling pre-ordinary stocks in this department. Prices show falls ranging from one point to three points on the week, the heaviness being common to the list as a whole. Nor have the ordinary stocks managed to stand up against the weak tendency which developed in the senior issues.

Underground Electric incomes are a point lower at 108, and the shares eased off to 22s. 6d., at which it will be observed that the yield on the money, on the basis of the last 8 per cent. dividend declared, comes to 7⅛ per cent. This would be accounted good if it were not for the fact that the ordinary stocks of the steam railways yield a still better rate, though the Underground is regarded as being less liable to labour and traffic troubles than are other companies. A little business continues to be done in the London Tramway descriptions. London United 4 per cent. debenture stock remains at 52½. The company intends to convert its present tramway system to one of railless traction. British Electric Traction has lost the 50 points gained by the price last week.

Metropolitan consolidated stock remains at 66½, no change having occurred in the price as a consequence of the tragic death in St. Paul's Cathedral of Mr. R. H. Selbie, the general manager, and a director of the company.

### Cables and Wireless.

After being up to 54, Cables & Wireless 7½ per cent. ordinary stock gave way to 48. It then partially rallied to 50, showing a fall on the week of 1½ points. The "B" ordinary stock is no better than 22½, being 3 lower, and the 5½ per cent. preference stock weakened to 93½ sellers. The reason for this fresh outbreak of flatness is the fear lest the "A" ordinary stock will receive a dividend not exceeding 2½ per cent. in respect of last year's working. Even what were regarded as extremely cautious estimates had allowed, up to the present, for a likely 3 per cent. on the "A" ordinary stock. If there is to be a reduction in the latter, the price of the stock may go still lower. The price of the preference has failed entirely to derive benefit from the lowered Bank Rate, and the cheaper conditions prevailing in the money market. It will be a very good thing when the dividend announcement comes out, when the first set of figures is published, and people can budget for what is likely to happen in the future. By way of commentary upon optimisms that can be entertained in regard to a speculative investment stock, it may be recalled that Cables "B" ordinary stood at one time, less than two years ago, at over 100, while the "A" has halved the prices which it commanded at that same time.

### Electricity Supply.

County of London ordinary eased off to 47s. 6d., Bournemouth and Poole to 58s. 9d., these falls being of 1/16 each. The market as a whole is steady, though Yorkshire Electrics lost 9d. to 33s, and Newcastle-on-Tyne at 23s. 3d. fell 6d. Fair lines of preference shares have come on offer. One lot was 5,000 Metropolitan Electric 4½ per cent. preference, which was snapped up almost as soon as it came to market, the price being 17s. 9d. Although the yield on the money is certainly modest, the shares have the advantage of being redeemable at £1 in 1971. Within the last day or two, 5,000 Yorkshire Power 6 per cent. preference came on offer at 23s. 9d. Although these afford the comparatively small return of £5 1s. 1d., this is compensated for by the expectation that the shares will participate in new issues that are made from time

to time by the Yorkshire Electric Power Company. No obligation lies upon the company, so far as we are aware, to bring preference shares into line with the ordinary in regard to participation in new issues, but up to the present the two classes have ranked together when further money has been required, and the preference, as well as the ordinary, have shared in the bonuses to which the new issues give rise.

Scottish Electric new shares hold their premium of 1s. Northamptons have further risen to 46s. 6d. County new shares are easier at 8s. 6d. premium. Clyde Valleys are 1s. 9d. up, at 38s. 9d.

## Dollar Stocks.

It becomes increasingly apparent that the much-advertised trade animation in the United States is not quite so solid as people on this side are intended to believe. Every week there are fresh indications which suggest that over-production is almost as rife in the Americas as it is on this side of the Atlantic. The utility companies are finding it less easy than they did six months ago to obtain capital for expansion, and this in spite of the fact that money has become cheaper, and should be more readily obtainable. Brazilian Tractions, after their recovery of 4 points last week, have gone back a little to 50. The preference shares are quoted at 160. Shawinigans are steady at 78. Power Corporation of Canada, at 85½, are a point lower. Montreal Light & Power shares have fallen 6½ to 130. Pennsylvania Light & Power shares are easier at 83¼. Hydro-Electrics drooped to 46¾, and International Holdings are 6¾. British interest in American utilities has given place to a condition approaching stagnation. Instead of stopping to deal up to 8 o'clock at night in Throgmorton Street, as they were doing a few weeks ago, London Stock Exchange jobbers in American shares now find there is little to do after half-past five. The change in the situation within so short a time is difficult to comprehend. Presumably a good deal of the previous animation owed its excitement to professional dealings. American Telephone & Telegraph, after being better, fell back 3 points to 252, and Internationals at 64 are a trifle down. British Columbia Power Corporation reports a decrease in net earnings of $280,000, for the ten months ended last month. The "A" shares are quoted at 42¾ and the "B" at 21¾. Canadian General Electrics have gone back to 400.

## Mexican Movements.

Mexico Tramways 5 per cent. bonds hold their price at 70, but the 6 per cent. seconds weakened to 52½. Mexican Light and Power 5 per cent. first mortgage hardened to 81, yet the second mortgage bonds receded to 70. Mexican Electric Light 5 per cents. are better at 75.

## Manufacturing Shares.

The dulness which crept into the list of prices in manufacturing companies' shares a week ago continues in most cases. Telegraph Constructions are £1 down at 20½. Henleys shed 2s. 6d., going back to 6⅜. There are falls in British Insulated ordinary and Electric Constructions. The latter, which came up from 11s. 3d. to 23s. 9d., have reverted to 16s. 3d. Associated Electrical Industries ordinary at 27s. 6d. show a slight improvement. Philips Lamps revolve around 68s. General Electrics have been up to 52s. 3d., reacting to their previous price of 2 9/16.

## Indian Shares.

The Burma Electric Company announces that there will be no interim dividend on its ordinary shares, owing, amongst other things, to the competition of 'buses. The price of the ordinary shares has gone back to 12s. 6d., and the 6 per cent. preferences are quoted at 16s. 3d. Delhi Electric Supply and Traction ordinary changed hands early this week at 34s. 3d. Calcutta Tramways were last done at 13s., the 5 per cent. preference shares at 12s. 9d. The company's 7 per cent. second debentures are now ex dividend, and the price is 94½. Madras Electric Tramways 6 per cent. preference are dull at 10s. for the £1 shares; the 5½ per cent. debentures stand at 76½. Rangoon Electric Tramway & Supply preference hold their ground at 20s. A recovery of 1s. 6d. lifted Calcutta Electric Supply shares to 48s. 6d.

## Miscellaneous Matters.

Globe Telegraph and Trust ordinary shares are flat at 21, by reason of the drop in Cables & Wireless issues. Anglo-American Telegraph deferred weakened to 24¼. Marconi Marines fell back to 40s. Victoria Falls ordinary are 6d. down at 63s. 3d. Constantinople Telephones are better at 3. A Continental telephone co-operation has been initiated between Siemens, of Berlin, and Ericssons, of Stockholm, presumably with the idea of competing against the American interests. A new company is to be formed to handle the Greek telephone concession recently secured by Siemens, and the orders, according to report, will be shared between the two undertakings, Siemens and Ericssons. The latter company's 7 per cent. preference shares are quoted at 20s. 9d. in London.

Babcock & Wilcox are better at 56s. 3d.: Vickers have declined to 7s. The rubber market is in the doldrums, its prices depressed by further weakness in the price of the raw product.

# Share List of Electrical Companies.

### Home Electricity Companies.

| | Nom. | Approx. Dividend. 1928. | 1929. | Price May 20 1930. | Rise or fall | Yield p.c. |
|---|---|---|---|---|---|---|
| | £ | | | | | |
| Bournemouth and Poole | 1 | 15 | 15 | 58/9 | —1/6 | 5 2 9 |
| Brompton Ordinary | 1 | 8½ | 8½ | 26/6 | — | 5 5 8 |
| Charing Cross Ordinary | 1 | 8½ | 8½ | 27/6 | — | 5 1 10 |
| do. do. 4½% Pref. | 1 | 4½ | 4½ | 17/- | — | 5 6 0 |
| Chelsea | 1 | 8½ | 8½ | 26/6 | — | 5 5 8 |
| City of London | 1 | 10 | 10 | 33/3 | — | 4 4 6 |
| do. do. 6% Pref. | 1 | 6 | 6 | 22/6 | — | 5 6 8 |
| Clyde Valley | 1 | 8 | 8 | 38/9 | +1/9 | 4 2 6 |
| County of London | 1 | 7 | 10 | 47/6 | —1/6 | 4 4 5 |
| do. do. 6% Pref. | 1 | 6 | 6 | 23/- | — | 5 4 4 |
| Edmundson's 7% Pref. | 1 | 7 | 7 | 24/6 | — | 5 14 3 |
| Elec. Supply Corporation | 1 | 11 | 11 | 47/- | — | 4 13 7 |
| Kensington Ordinary | 1 | 8 | 8 | 26/- | — | 5 7 8 |
| Lancs. Light and Power | 1 | 7½ | 7½ | 27/- | — | 5 11 1 |
| London Electric | 1 | 8½ | 9 | 29/6 | — | 4 15 0 |
| Metropolitan | 1 | 9 | 10 | 41/3 | — | 4 17 0 |
| do. 4½% Pref. | 1 | 4½ | 4½ | 17/6 | — | 5 2 10 |
| Midland Counties | 1 | 6½ | 7 | 28/6 | — | 4 16 3 |
| Mid. Elec. Power | 1 | 15 | 8 | 32/- | — | 5 0 0 |
| Newcastle-on-Tyne Ordinary | 1 | 6 | 6 | 23/3 | —6d. | 5 3 1 |
| do. 7% Pref. | 1 | 7 | 7 | 25/6 | — | 5 9 10 |
| Notting Hill 6% Pref. | 10 | 6 | 6 | 10½ | — | 5 11 4 |
| North Met. Elec. 6% Pref. | 1 | 6 | 6 | 22/6 | — | 5 5 9 |
| St. James' and Pall Mall | 1 | 8 | 8 | 27/6 | — | 5 1 10 |
| Scottish Power | 1 | 8 | 8 | 29/- | — | 5 3 3 |
| South London | 1 | 8½ | 8½ | 27/6xd | — | 5 1 10 |
| Urban Ordinary | 1 | 7 | 7 | 33/9 | — | 4 2 10 |
| Westminster Ordinary | 1 | 8½ | 8½ | 27/ | — | 5 3 8 |
| Whitehall Elec. Invst. 7½% Pref. | 1 | 7½ | 7½ | 24/6 | — | 6 2 5 |
| Yorkshire Elec. | 1 | 8 | 8 | 33/- | —9d. | 4 17 0 |

### Home Rails.

| | | | | | | |
|---|---|---|---|---|---|---|
| Central London Ord. Assented | Stock | 4 | 4 | 77 | — | 5 4 0 |
| Metropolitan | ,, | 3½ | 4 | 66½ | — | 6 0 4 |
| do. District | ,, | 4 | 5 | 77½ | — | 6 9 0 |
| Underground Electric | £1 | 7 | 8 | 22/6 | —6d. | 7 2 8 |
| do. do. Income | Bonds | 6 | 6 | 108 | —1 | 5 11 2 |

### Telegraphs and Telephones

| | | | | | | |
|---|---|---|---|---|---|---|
| Anglo-Am. Tel. Pref. | Stock | 6 | 6 | 109½ | +1 | 5 16 0 |
| do. Def. | ,, | 1⅛ | 1⅛ | 24⅜ | —⅛ | 6 1 3 |
| Automatic Telephone | 1 | 10 | 12½ | 37/6 | — | 6 13 4 |
| Cables & Wireless 5½ Pref. | Stock | — | 5½ | 93½ | — | 5 17 8 |
| do. A 7½ Ord. | ,, | — | — | 50 | —1½ | ... ... |
| do. B Ord. | ,, | — | — | 22½ | —3 | ... ... |
| Globe Tel. and T. Ord. | 10 | 10 | 10 | 21 | —½ | *4 15 3 |
| do. do. Pref. | 10 | 6 | 6 | 11¼ | — | 5 9 1 |
| Great Northern Tel. | 10 | 20 | 20 | 32 | — | 6 5 0 |
| Marconi-Marine | 1 | 12½ | 15 | 2 | —5/16 | 7 5 10 |
| Oriental Telephone Ord. | 1 | 12 | 12 | 55/6 | — | *4 6 9 |

### Home and Foreign Trams, &c.

| | | | | | | |
|---|---|---|---|---|---|---|
| Anglo-Arg. Trams First Pref. | £ | 5½ | 5½ | 2¹³/₁₆ | — | 9 7 2 |
| do. do. 2nd Pref. | 5 | 6 | 6 | 2⅞ | — | 10 8 8 |
| do. do. 5% Deb. | Stock | 5 | 5 | 70½ | — | 7 0 0 |
| British Electric Traction Def. Ord. | ,, | 5 | 5 | 1750 | —50 | ... ... |
| do. do. Pref. Ord. | ,, | 8 | 8 | 126½ | — | 6 6 6 |
| Brazil Traction | 100 | 7 | 8 | 50 | —1 | 4 0 0 |
| Brit. Columbia Elec. Rly. Pcc. | Stock | 5 | 5 | 94½ | +1 | 5 7 0 |
| London & Sub. Trac. 5% Pref. | 1 | Nil | Nil | 10/- | — | ... ... |
| London United Tram Deb. | Stock | 4 | 4 | 52½ | — | 7 12 4 |
| Mexico Trams, 5% Bonds | — | 5 | 5 | 70 | — | 7 2 10 |
| Mexican Light Common | 100 | Nil | Nil | 82½ | — | ... ... |
| do. 7% Pref. | 100 | 7 | 7 | 76½ | — | 9 3 0 |
| do. 1st Bonds | — | 5 | 5 | 81 | +1 | 6 5 0 |
| Victoria Falls Ord. | 1 | 15 | 15 | 63/3 | —6d. | 4 14 4 |
| Yorkshire (West Riding) | | Nil | Nil | 5/- | — | ... ... |

### Manufacturing Companies.

| | | | | | | |
|---|---|---|---|---|---|---|
| Assoc. Elec. Ord. | 1 | 6 | 6 | 27/6xd | +9d. | 4 7 3 |
| Babcock & Wilcox | 1 | 13 | 15 | 56/3 | —1/6 | *5 6 5 |
| British Aluminium Ord. | 1 | 10 | 10 | 45/- | — | 4 9 0 |
| British Elec. Transformer Pref. | 1 | 7 | 7 | 8/9 | — | ... ... |
| British Insulated Ord. | 1 | 15 | 15 | 3¾ | —1/6 | 4 0 0 |
| Brush Ord. | Stock | 10 | 10 | 127½ | — | 7 17 0 |
| Callenders | 1 | 15 | 15 | 3⅜ | — | 4 3 0 |
| do. 6½% Pref. | 1 | 6½ | 6½ | 23/9 | — | 5 9 5 |
| Crompton Parkinson Ord. | £/- | — | 30 | 23/9 | — | 6 16 4 |
| do. 8% Pref. | 1 | 8 | 8 | 24/6 | — | 6 10 8 |
| Edison-Swan 1st. Pref. | 1 | 7½ | 7½ | 24/6 | — | 7 1 2 |
| do. 5% Deb. | Stock | 5 | 5 | 84½ | — | 5 18 4 |
| Electric Construction | 1 | 7½ | 5½ | 16/3 | —½ | 6 15 4 |
| Enfield Cable Ord. | 1 | 20 | 20 | 4½ | — | 4 14 1 |
| English Electric | 1 | Nil | Nil | 3/9 | — | ... .. |
| do. do. Pref. | 1 | 3 | Nil | 7/6 | — | ... ... |
| Gen. Elec. Pref. | 1 | 6½ | 6½ | 23/6 | — | 5 10 7 |
| do. Ord. | 1 | 10 | 10 | 51/3 | — | 3 16 0 |
| Henley | 1 | 25 | 30 | 6⅜ | —⅛ | 4 14 1 |
| do. 4½% Pref. | 5 | 4½ | 4½ | 4½ | — | 5 6 0 |
| India-Rubber | 1 | Nil | Nil | 10/- | — | ... ... |
| Johnson & Phillips | 1 | 10 | 10 | 1 | — | 5 6 8 |
| Siemens Ord. | 1 | 7½ | 7½ | 24/6 | —6d. | 6 2 5 |
| Telegraph Construction | 12 | 10 | 10 | 20½ | —1 | *5 17 0 |

* Dividends paid free of Income Tax.

# Our Foreign Electrical Trade.

## Electrical Exports and Imports during April.

THE influence of the Easter holiday is apparent in the statistics of our overseas electrical trade during April, and the figures of both exports and imports are low but not lower than is usual for the Easter month. The decrease was, proportionately, far greater in the case of imports than in the export total. Last year Easter Day fell on March 31st and the holiday was thus divided between two months. In March, 1929, the exports amounted to £1,372,691, which was below last month's figure. In spite of the general decrease in imports during April, the telegraph and telephone section showed a substantial increase (£74,371) as compared with the preceding month, due mainly to larger shipments of instruments and apparatus. As opposed to this, the machinery classes showed a combined decrease of £96,333, all three items contributing to this decline. Unenumerated goods and insulated wires and cables also recorded large falls. In comparison with April, 1929, the month's exports declined by over a quarter of a million pounds. This is seen to be due in a considerable measure to a decline of £124,253 in the telegraph and telephone section, particularly in the case of wires and cable. The machinery section as a whole was responsible for £35,030 of the decrease, in spite of a rise in the exports of "other" motors and generators.

It is perhaps satisfactory to observe a substantial fall in imports of electrical goods and machinery when the figure has been at such a high level for the past year. Apart from the effects of Easter it would appear that there is now a definite downward tendency; each month this year the total has shown a reduction. It will be noticed, however, that the decrease as compared with March was entirely due to smaller imports of goods and apparatus; machinery recorded a small increase. Meters and instruments were the item showing the greatest fall, but this was because the March imports of this class were very high. Other sections in which imports were substantially lower were unenumerated goods, telegraph and telephone apparatus, and batteries and accumulators. In the comparison with April last year the outstanding change is an increase of £121,719 in the value of imported meters and instruments. This is an item which has been of some magnitude for the past few months. The machinery section again exhibits an increase, as do insulated wires and cables. Telegraph and telephone instruments and apparatus showed the greatest decrease.

The inset table shows the distribution of our exports of electrical machinery during April and the figures of weight and value are compared with those for April, 1929. It is noteworthy that although there was an advance in weight the value fell, indicating a lower price level. There was a substantial decrease in shipments to India, but satisfactory rises occurred in the shares of South America and New Zealand.

| Destination. | Quantities. April, 1929. Tons. | April, 1930. Tons. | Inc. or dec. Tons. | Values. April, 1929. £ | April, 1930. £ | Inc. or dec. £ |
|---|---|---|---|---|---|---|
| Europe ... ... | 1,692 | 2,142 | + 450 | 93,891 | 85,801 | − 8,090 |
| Japan ... ... | 842 | 102 | − 740 | 10,764 | 5,517 | − 5,247 |
| South America... | 898 | 1,313 | + 415 | 28,847 | 44,966 | +16,119 |
| South Africa ... | 923 | 1,520 | + 597 | 60,506 | 42,538 | −17,968 |
| British India ... | 4,088 | 2,377 | −1,711 | 146,174 | 81,740 | −64,434 |
| Australia ... | 2,275 | 2,539 | + 264 | 71,761 | 56,686 | −15,075 |
| New Zealand ... | 600 | 1,037 | + 437 | 15,242 | 35,973 | +20,731 |
| Canada ... | 474 | 757 | + 283 | 18,841 | 22,539 | + 3,698 |
| Other countries | 1,918 | 2,449 | + 531 | 64,318 | 99,554 | +35,236 |
| Totals ... | 13,710 | 14,236 | + 526 | £510,344 | £475,314 | −£35,030 |

| | Exports. Electrical exports for April, 1930. | Inc. or dec. as compared with March, 1930. | Inc. or dec. as compared with April, 1929. | Imports. Electrical imports for April, 1930. | Inc. or dec. as compared with March, 1930. | Inc. or dec. as compared with April, 1929. | Re-Exports. Electrical re-exports for April, 1930. | Inc. or dec. as compared with March, 1930. | Inc. or dec. as compared with April, 1929. |
|---|---|---|---|---|---|---|---|---|---|
| Electrical goods and apparatus (unenumerated) ... ... | £225,832 | −£89,776 | − £52,327 | £124,503 | − £20 030 | − £7,781 | £11.944 | +£2,521 | +£5,347 |
| Insulated wires and cables ... | 256,062 | − 49,106 | − 29.179 | 79,828 | + 7 453 | + 14,014 | 348 | − 1 | − 161 |
| Glow lamps ... ... ... | 35,104 | − 7,200 | − 17.534 | 22,226 | − 4,645 | − 1,150 | 1,036 | − 1,471 | + 339 |
| Arc lamps and parts ... ... | 1,153 | + 138 | − 887 | 1,795 | − 253 | + 1,429 | 89 | + 89 | + 48 |
| Batteries and accumulators ... | 71,392 | − 12,373 | − 4.759 | 33.074 | − 13,301 | − 9,551 | 408 | − 410 | + 210 |
| Meters and instruments ... | 30,880 | − 4,157 | + 847 | 136 244 | − 78,986 | + 121,719 | 1,852 | + 386 | + 554 |
| Carbons ... ... ... | 1,134 | + 976 | + 436 | 15 886 | − 8,155 | − 5,883 | 142 | − 762 | − 76 |
| Switchboards (not telegraph or telephone) ... ... | 4,272 | − 8,770 | − 785 | 119 | − 123 | − 12 | — | — | |
| *Electrical Machinery—* | | | | | | | | | |
| Electrical machinery (unenumerated) ... ... ... | 287,166 | − 52,332 | − 41,926 | 163,150 | + 3 698 | + 17,173 | 9,371 | + 392 | − 2,474 |
| Railway and tramway motors | 4,262 | − 12,872 | − 11.316 | — | — | — | — | — | — |
| Other motors and generators... | 183,886 | − 31.129 | + 18 212 | — | — | — | — | — | — |
| *Telegraph and Telephone Cable and Material—* | | | | | | | | | |
| Telegraph and telephone wires and cable (not submarine) | 71.089 | + 650 | − 74,479 | 2,153 | + 496 | − 3,918 | — | 42 | — |
| Submarine telegraph and telephone cable... ... ... | 20,564 | + 9,929 | − 700 | — | — | — | — | — | — |
| Telegraph and telephone instruments and apparatus ... | 217,967 | + 63,792 | − 49,074 | 73,987 | − 16,368 | − 16,312 | 3,681 | − 14,475 | − 981 |
| Totals ... ... | £1,410,763 | −£192,230 | − £263,471 | £652,965 | − £130,214 | +£109,728 | £28,871 | −£13,773 | +£2,800 |
| Increases for first four months of 1930. ... ... ... ... | | | Exports £290,580 | | | Imports £932,128 | | | Re-Exports £129,393 |

# Pollution of the Atmosphere.

## Extracts from the Report for 1927/28 of the Superintendent of Observations.*

THE Department accepted responsibility, as from April 1st, 1927, for co-ordinating the local observations of atmospheric pollution, and for carrying out research into the nature of this pollution and the best ways of measuring it. It has undertaken this task at the request of a number of local authorities, and of certain supply undertakings and industrial concerns, which have promised to contribute between them at least half its cost.

### Results Obtained by Deposit Gauges.

The figures given in this Report may be affected, not only by casual error on the part of the observers, but also by the nature of the exposure of the deposit gauges. The degree of shelter of a gauge has a marked effect on the quantity of impurity caught; the more sheltered it is the less the deposit. Again, the weather affects the amount of pollution recorded; the amount of rainfall, for example, governs to some extent the quantity of soluble impurity deposited. Nevertheless the figures given provide a reasonably correct view of the relative quantities of impurity deposited at different stations.

Attention is drawn to the importance of tar and sulphates, as both are practically entirely products of combustion. The highest mean monthly deposit of carbonaceous matter was at Newcastle-on-Tyne, which has had the highest deposit for three consecutive years. Sulphates during the current year made their highest deposit at Burnley; this was also true of last year. The highest mean monthly deposit of tar was at Salford, Peel Park, and Regent Square; the next highest being Newcastle-on-Tyne, City Road. The actual weight of tar deposited per sq. mile during the year was 36 tons at Salford, and 20 tons at Newcastle. The weight of sulphates deposited at Burnley in the year reviewed was 140 tons per sq. mile.

The condition of London shows no improvement, but rather a falling back, as in seven out of the eight available stations, the sulphates and tar have increased when compared with the general average. At the 23 stations which show tar and sulphate deposits, the tar is higher than the general average in 11 stations, and equal to or less than the general average in 12, while the sulphates are higher than the general average in 22, and lower in 1 only. This shows that the progress in purification of the air has not made such rapid advances as many people imagine.

In London, from the average of all stations, the deposit of total solids has risen from 11,841 metric tons per 100 sq. kilometres last year to 12,336, while the sulphates fell from 1,564 to 1,552 and the percentage from 13 to 12.

In Glasgow the deposit of total solids has risen on the average of all stations from 11,149 in 1926-27 to 12,489 for the current year, while the sulphates have risen from 1,667 to 1,973, and the percentage of sulphates in the total solids has increased from 15 to 16. Here the higher percentages of sulphates were at stations showing low deposit. There seems, therefore, to be a tendency for the higher percentages of sulphates to accompany low total solids and the low percentages to accompany high total solids.

A rapid improvement in the state of the atmosphere is indicated between the years 1915-16 and 1921-22, but in both cases the improvement has apparently ceased in the latter year. In the case of London the total deposit in 1915-16 was 415 tons per sq. mile, or 162 metric tons per sq. kilometre; this fell to about 300 tons in 1921-22, and has remained at that figure with slight variations from year to year until the present date, the 1927-28 deposit being 316 tons per sq. mile.

In the case of Glasgow the total deposit in 1915-16 was 422 tons per sq. mile, or 165 metric tons per sq. kilometre. This fell to 255 tons per sq. mile in 1921-22, and since then has remained practically constant, but with a slight tendency to increase up to the present date, so that the 1927-28 deposit was 320 tons per sq. mile.

Sulphates are practically entirely derived from burning fuel, and we find that the sulphate deposit has behaved in exactly the same way as the total deposit. In London in 1915-16 the deposit of sulphates was 72 tons per sq. mile, or 28 metric tons per sq. kilometre; this fell to 25 tons per sq. mile, or 9.6 metric tons per sq. kilometre, in 1921-22. Since then there has been a tendency to increase in quantity to 1927-28, when the amount of deposit was 40 tons per sq. mile.

In the case of Glasgow the deposit of sulphates in 1915-16 was 92 tons per sq. mile, or 36 metric tons per sq. kilometre; this fell to 34 tons per sq. mile in 1921-22 and has since increased up to 1927-28, when it was 50 tons per sq. mile.

One hypothesis which might explain the cessation of improvement is that the number of gas and electric heaters replacing coal fires has reached a saturation point, having regard to the economics of the question, and the general conditions governing the replacement of coal by gas or electricity. It may very well be that other causes are at work, but it is certainly remarkable that the changes in the quantity of deposit from the air should follow so accurately the same course in both of these cities.

### Results Obtained with Automatic Filters.

At Kew Observatory the general distribution is the same on hazy days as on ordinary days, except that there is during hazy days a tendency for the peaks to be a little later, as they are due to the accumulation of smoke, the escape of which from over the city is impeded by the conditions prevailing at the time. For example, the morning maximum on hazy days occurs at 10 a.m., while on ordinary days it occurs at 9 a.m. Again, the evening maximum occurs at about 7 to 9 p.m. on ordinary days, and at 10 p.m. on hazy days.

The maximum at the Meteorological Office is at 9 a.m. on both "ordinary" and hazy days, while in Victoria Street it occurs at 10 a.m in both cases. There is the same tendency at South Kensington for an afternoon maximum at about 6 to 7 p.m., but this is not found in the curve for hazy days at Victoria Street.

With regard to the quantity of suspended sooty matter, Victoria Street shows a higher value than South Kensington, for both types of days. While the maximum occurs an hour earlier at the Meteorological Office, the morning rise also begins earlier than at Victoria Street.

In the curves for all places the same general distribution holds good—that is, a comparatively clean period from midnight to about 5 a.m. or 6 a.m., followed by a rapid rise of impurity. The only part of the twenty-four hours which is comparatively clean for these cities is the night time, when many people have left to get into the clean air of the country.

### Measurement of Daylight.

During the years 1926 and 1927 a series of tests has been carried out at Salford with the idea of arriving at a comparative measure of the strength of sunlight in different districts. The method used consists in the exposure of a solution of potassium iodide acidified with sulphuric acid, in a 2-oz. glass bottle, in the presence of air. Free iodine is liberated by the action of the sunlight, and the amount found is proportional to the light received. The glass bottle transmits, of course, very little of the sun's ultra-violet radiation, but sufficient photo-chemical action takes place in the solution to give comparative results for the strength of light received in different districts.

The strength of the solutions used is as follows: potassium iodide solution, 2 per cent., and sulphuric acid solution, 11.85 gm. per litre; 10 c.c. of each of these solutions are placed in the glass bottle. After exposure the free iodine is titrated against standard thiosulphate solution, 1 c.c.=0.001 gm. I. A fresh bottle is exposed each morning, and the bottle exposed the previous day is placed in a closed tin until titrated. If the solution is kept twenty-four hours or more before titration a blank should be put on at the same time as the solution to be exposed, kept in the dark, and titrated at the same time as the latter. Each bottle is placed on a white tile during exposure, in such a position that no shadow falls on it.

The coal stoppage of 1926, which lasted from May to October, was responsible for a considerable diminution of the amount of dust and smoke in the atmosphere, and this effect was probably at a maximum during the last six months of the year, *viz.*, July to December, the effect of the dispute on coal stocks being most acute during this period.

Whereas the totals for the outer stations are approximately the same throughout 1926, the figure for Regent Road, a main thoroughfare in a densely-populated district, for the period July to December, 1926, was about 17 per cent. higher than that for the previous six months, showing that the central area indirectly benefited by the stoppage, in that the amount of sunlight received during the period affected was much greater than it otherwise would have been.

During the earlier months of the year the figure for Regent Road was consistently lower than those for the other three stations, but during the months affected by the dispute it rose considerably in proportion, and for two months, July and September, it was actually higher than all the others.

The report concludes with the statement that, while the quantity of ultra-violet radiation has no exact relation to the deposit, it is evident from a comparison with the general deposit figures that there is a close connection, the high deposit being accompanied by low ultra-violet penetration.

A large number of tables is presented showing the deposits and all their components at the different observation stations.

* "The Investigation of Atmospheric Pollution." 14th Report for year ended March 31st, 1928. Department of Scientific and Industrial Research. H. M. Stationery Office, 3s. 6d. net.

# A Switchgear Development.

**A range of oil circuit breakers recently introduced by Messrs. Ferguson, Pailin, Ltd., has been designed with tanks approximating as nearly as is commercially possible to the ideal spherical shape.**

AN electrical problem in this country in the future will be how to substitute higher-rupturing-capacity circuit breakers for those already installed, in view of the more onerous duties to be imposed on this class of equipment.

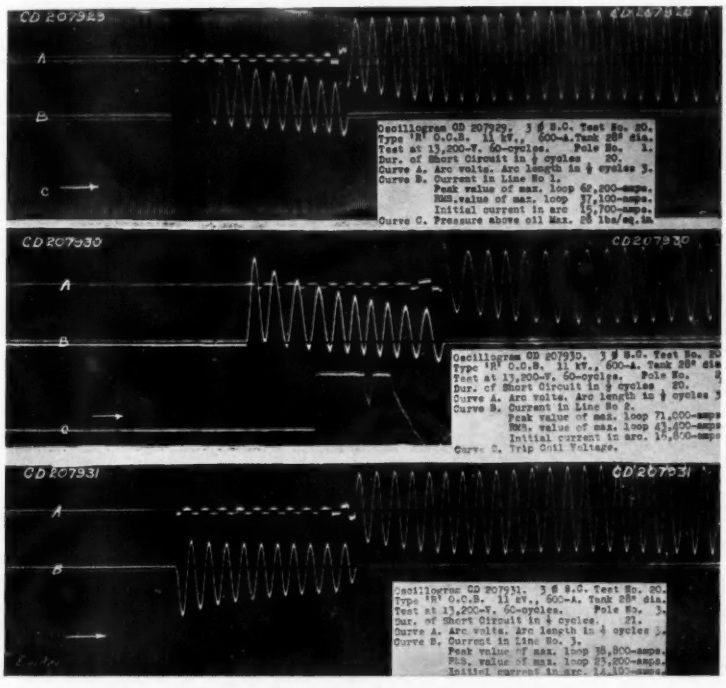

CD 207929
A
B
C
Oscillogram CD 207929. 3 ϕ S.C. Test No. 20.
Type 'R' O.C.B. 11 kV., 600-A. Tank 28" dia.
Test at 13,200-V. 60-cycles. Pole No. 1.
Dur. of Short Circuit in ¼ cycles 20.
Curve A. Arc volts. Arc length in ¼ cycles 3.
Curve B. Current in Line No 1.
Peak value of max. loop 62,200-amps.
RMS.value of max. loop 37,100-amps.
Initial current in arc 15,700-amps.
Curve C. Pressure above oil Max. 28 lbs/sq.in.
CD 207930
Oscillogram CD 207930. 3 ϕ S.C. Test No. 20
Type 'R' O.C.B. 11 kV., 600-A. Tank 28" dia
Test at 13,200-V. 60-cycles. Pole No. 2
Dur. of Short Circuit in ¼ cycles 20.
Curve A. Arc volts. Arc length in ¼ cycles 3
Curve B. Current in Line No 2.
Peak value of max. loop 71,000-amps
RMS. value of max. loop 42,400-amps
Initial current in arc. 16,800-amps
Curve C. Trip Coil Voltage.
CD 207931
Oscillogram CD 207931. 3 ϕ S.C. Test No. 20.
Type 'R' O.C.B. 11 kV., 600-A. Tank 28" dia.
Test at 13,200-V. 60-cycles. Pole No. 3.
Dur. of Short Circuit in ¼ cycles. 21.
Curve A. Arc volts. Arc length in ¼ cycles 3.
Curve B. Current in Line No. 3.
Peak value of max. loop 78,800-amps.
RMS. value of max. loop 45,200-amps.
Initial current in arc. 14,100-amps.

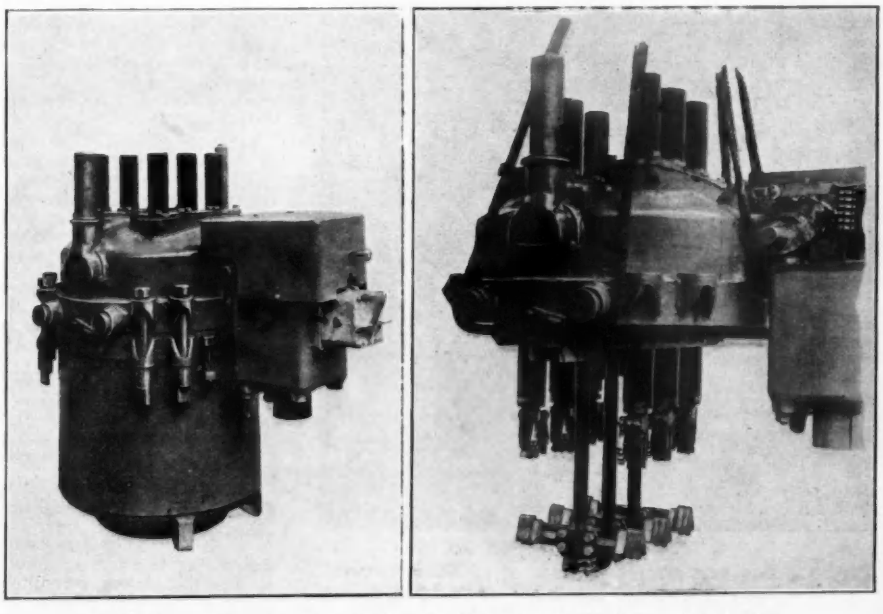
**Fig. 1.—Oscillograms of Short-circuit Test on 28-in. diameter Breaker.**

American and German engineers are claimed to have solved the problem by adopting exceptionally robust breakers incorporating the three phases in a common cylindrical tank. After some tens of thousands of rupturing tests this form of construction was found to be the most suitable for moderate rupturing capacities and to occupy the minimum of space, and as a result Messrs. Ferguson, Pailin, Ltd., decided that circuit breakers of this class, approaching the ideal spherical shape for balancing stresses, with minimum weight, would have an application in this country. They have, therefore, adopted a design which has been proved, it is claimed, by extensive rupturing tests. A complete range has been developed, comprising 16 in., 20-in., 24-in., 28 in., 32 in., and 36-in. tank diameter breakers, and further developments are in progress for increasing the range, so that it will incorporate both smaller and larger sizes of circuit breakers.

The particular range of breakers is known as the "R" series, the breaking-capacity ratings ranging from 100,000 kVA upwards. The ratings are claimed to be not merely estimates, and it will be of interest to briefly outline the nature of the tests which led up to the final design of the breakers. The test generator is capable of delivering 500,000 kVA under 3-phase short-circuit conditions for several seconds by direct generation at 14,500 volts and frequencies up to 60 cycles per second. The power ruptured by the breakers is controlled by reactors capable of adjustment to suit each investigation, and oscillographs are used to record the current, line voltage, arc voltage, breaker speed, &c., while in addition several special instruments are used to record speed of break, arc energy, gas formation, pressure, &c., during interruption. As many as six three-element oscillographs have been used simultaneously to record the phenomena during short-circuit tests. In addition to the exhaustive testing in the development works, many experimental sample breakers have been tested to obtain data and formulæ.

The purpose of the large number of tests was, first, to demonstrate that the breakers could rupture the definite interrupting values assigned to them, and, secondly, to so proportion and co-relate details of the design as to produce breakers having well-balanced characteristics with small dimensions and weights and, at the same time, liberal factors of safety. Fig. 1 shows the oscillograms produced during a three-phase short-circuit test at 13,200 V on a type R 11 kV, 600-A, 28-in. tank-diameter oil circuit breaker.

Although tests involved the clearing of fifteen short-circuits, in seven of which the ruptured kVA was between 300,000 and 422,000, the arcing surfaces were only moderately affected, and to an extent which would not have prevented continued operation in service before adjustment of the contacts. Fig. 4 shows that the arcing was restricted to the arcing contacts. Throughout the whole series of tests only a very small discharge of oil vapour was noticeable, but no oil was thrown.



**Figs. 2 and 3.—An "R" Circuit Breaker; Exterior and Interior.**

Typical F., P. circuit breakers designed on similar lines to the parent American breaker were forwarded to America and subjected to short-circuit tests, and in all cases scores

of over-rated and under-rated short-circuits were interrupted successfully.

Figs. 2 and 3 show a typical breaker of the series. The tank consists of a rolled-steel plate with a pressed-steel bottom, dished out from the inside, a skirt ring being fitted to the outside to enable the complete breaker, when withdrawn, to stand in an upright position. A rolled-steel clamp ring, with a turned upper lip, is shrunk on to the outside of the tank rim, and all the parts are heavily electro-welded, inside and out, to form a rigid tank. On the heavier-current sizes steel pipes are welded to the tank sides in order to assist cooling of the oil. The tank is closed in by a dome-shaped top plate, complete with self-contained fixings, and a rolled-steel fixing ring is shrunk and welded to the dome. The lower surface of the fixing ring has a machined annular groove for the reception of a gasket ring. The weight of the complete breaker is carried from the fixing ring, and the tank is fastened to the top plate by means of clamp bolts which are short in order to eliminate troubles due to elongation, when the breaker is under short-circuit stress. These bolts are of solid-drawn steel of uniform size, but they are varied in number to suit particular breaking-capacity ratings. A gasketed, gas- and oil-tight joint is obtained between the lip on the tank clamp ring and the bottom of the groove in the dome fixing ring, and, in addition, the lip and groove interlock and render mutual support when internal tank pressures occur. The switch dome is of fabricated pressed-steel construction in the smaller ratings, but with inserts of high-strength, non-magnetic material around the terminal bushings in the larger sizes; the inserts minimise the heating due to magnetic causes. For the larger currents in the series the entire dome is made of non-magnetic steel.

The operating mechanism is housed in the upper portion of the top dome, so that the exterior of the breaker is free from complications and easily accessible for cleaning. The mechanical parts, therefore, are protected and self-oiling. The external operating effort is transmitted to the moving contacts *via* a rotating shaft and simple parallel motion whereby powerful closure and quick-opening characteristics are obtained. All parts of the dome are electro-welded together, inside and out, so as to obtain maximum rigidity. Fulcrum pins and links employed in the operating mechanism are of rust-resisting material. The movement is controlled by oil dash pots and adjustable stops which bring the rapidly-moving parts to rest without undue shock.

The terminal bushings are of the solid-bakelite variety, and are fixed to the top dome by means of " shrunk on " flanges. A gasket is provided between the flange and the top dome in order to prevent oil or gas leakage at that point. The stationary contacts consist of heavy copper fingers of the self-aligning wedge pattern, arranged in multiple pairs to suit particular current ratings. With parallel fingers arranged in pairs, the magnetic effect of heavy current increases the contact pressure, thus preventing heating and welding of the contact surfaces. The arcing fingers are longer and heavier than those for contact surfaces, thus ensuring that the current is shunted from the main contacts. The large amount of metal embodied in the arcing contacts increases their thermal capacity, and so helps to reduce the temperature at the root of the arc. The moving contacts consist of heavy copper angle

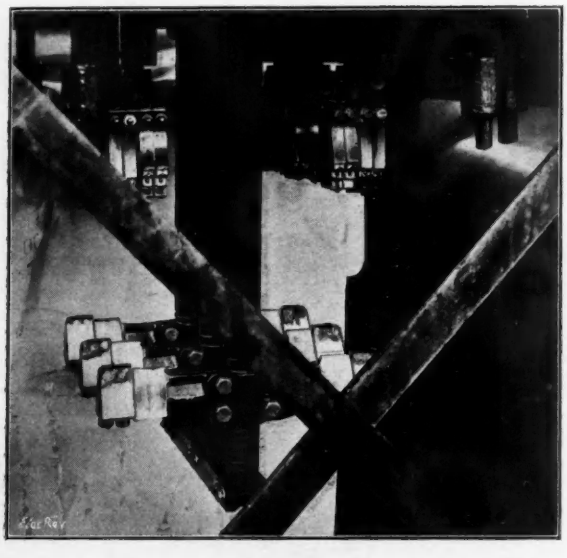


**Fig. 4.—Contacts after Clearance of 15 Short-circuits.**

bars and arc-resisting metal tips, so arranged that they can be replaced when excessively burnt. The contact surfaces are arranged at such an angle that the finger pressure assists the parting of the contacts. The features ensuring a quick rupture of the circuit are gravitational opening, magnetic repulsion (due to the current passing at the instant of the break), pressure of the throw-off springs, and the contact finger pressure referred to above. Internal tank pressures cannot retard rupture, owing to the operating mechanism being internal to the breaker, therefore there can be no unbalanced piston effect tending to close the breaker. The terminal bushings and the impregnated-wood operating rods are strongly braced with reinforced wooden clamp bars to ensure rigidity under the electro-magnetic stresses produced by the flow of short-circuit current through the breaker. All wood used in the construction is specially selected, kiln dried, and rigidly tested.

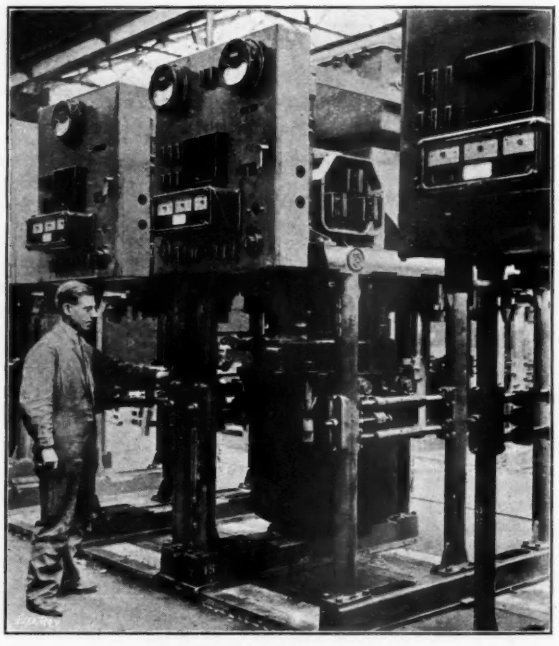


**Fig. 5.—Portion of Bank of " R " Circuit Breakers.**

A minimum amount of oil is used, consistent with the positive rupture of the circuit, and loss through oil throw and leakage is almost negligible; fire risk, therefore, is practically absent. In order to relieve any pressure of arc gases that may manifest itself in the tank, a small shielded vent hole is provided in the breaker dome. This communicates with a spacious pebble-filled chamber acting as an oil separator and gas cooler. The chamber is coupled to an ample outlet pipe for the conveyance of gases to a safe distance, entrapped oil returning to the tank after circuit rupture has been effected. Auxiliary insulation between phases and from live metal to the tank, under oil, is provided in the form of a heavy arc-resisting insulating lining, fitting close to the tank, together with two " U " shaped pieces of similar material which shroud the contacts of the centre phase and form effective arc barriers between phases. A protected glass oil-sight gauge is fitted.

Fig. 5 is a near view of a part of one of a number of banks of units exported for installation in South America. This installation is of the vertical-isolation metal-clad design, but the breakers are equally adapted for truck-type units, stationary steel cubicles, masonry cubicles, self-supporting and for panel or wall mounting. Provision is afforded for any breaker to be turned through 90 deg. in either direction to suit a particular mounting or connection arrangement.

All the breakers comply, it is claimed, with B.S.S. No. 116/1929.

## Large American Generators.

Mr. Matthew S. Sloan, president of the New York Edison Co. and associated companies, recently announced that the General Electric Co., of America, had been given a contract to build for the Hudson Avenue station of the Brooklyn Edison Co. two turbo-generators of 160,000-kW capacity each to meet the general growth of load on the system of five companies of which he is president. The total cost of the generators, boilers, and other necessary equipment will be $18,000,000. Both machines are expected to be in operation in 1931. They will be, it is claimed, of the most powerful single-shaft, single-unit design developed. The only other 160,000-kW single-shaft, single-unit turbo-generator in the world is located in the East River station of the New York Edison Co.

# New Electrical Devices, Fittings, and Plant.

**Readers are invited to submit particulars of new or improved devices and apparatus for publication in this section.**

## A New Resin-core Solder Wire.

Under the name of "Fluitin" the Kuppers Metallwerke G.m.b.H., Bonn on Rhine, has brought out a special solder wire for radio and other delicate electrical work. It is claimed to have excellent cleaning effect, and to afford rapid flow and binding of the soldering metal. The soldering points are given a coating of "Colophonium," and the perfect volatilisation of the flux during the process of soldering also furnishes, it is claimed, a double guarantee for absolute freedom from oxidation. The sale of "Fluitin" in this country is in the hands of Mr. P. Richard, 61, Fore Street, London, E.C.2.

## Portable Arc-welding Sets.

We have received from Messrs. Fredk. J. Gordon & Co., Ltd., 92, Charlotte Street, W.1, sole distributors for the British Isle for Hobart Bros., Troy, Ohio, some particulars of two "Constant Arc" portable welders, fig. 1, recently introduced by the latter company. One machine has an output up to 300 A, and a smaller machine will deal with up to 200 A. The larger machine has a motor of 15 h.p., 1,750 r.p.m. (2-phase, 3-phase, or d.c.), while the "Constant Arc" generator has a welding range loading at from 25 to 30 V of from 50 to 400 A. With it can be used all commercial electrodes in the following sizes: metallic, $\frac{1}{16}$ in. to $\frac{3}{4}$ in.; carbon, $\frac{1}{4}$ in. to $\frac{3}{4}$ in. The overall dimensions are 43 in. by 25 in. by 44 in., and the shipping weight is 1,500 lb. The motor of the smaller

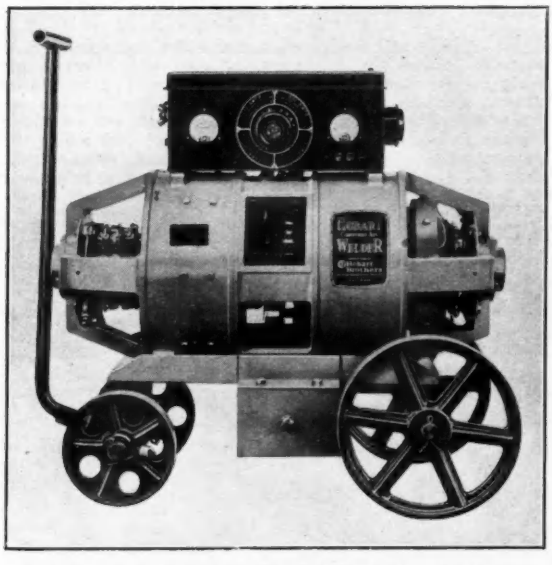


**Fig. 1.—A "Hobart Constant Arc" Welder.**

machine is of 10 h.p., and the generator will give from 50 to 300 A (25-30 V). It will take from $\frac{1}{16}$ in. to $\frac{1}{4}$ in. metallic electrodes, and from $\frac{1}{4}$ in. to $\frac{1}{2}$ in. carbon electrodes. Its dimensions are 39 in. by 24 in. by 40 in. long, and it weighs 1,225 lb. The main feature of these machines is the control system employed, which, it is claimed, is absolutely fool proof. The "Unitrol" dial on the front of the steel cabinet containing the controls gives, it is claimed, perfect control of the arc by simply moving the conveniently placed handle, and the dial markings indicate the correct settings and size of electrode for all thicknesses of material.

## A Portable Lighting Set.

Small Electric Motors, Ltd., Eagle Works, Church Fields Road, Beckenham, Kent, have recently developed a small portable lighting set called the "Semoco," fig. 2. It is of very neat design, compact, and fully protected by a framework made of bicycle tubing. Loops or straps are arranged so that carrying poles can be inserted and the machine handled with ease and safety by three men. The weight of the set in working order is 225 lb. The engine, comprising twin cylinders horizontally opposed and well balanced, is capable of developing 3½ h.p.; it is directly coupled to a specially designed generator which gives an output of 2 kW at a normal running speed of 1,600 r.p.m., governor controlled. Owing to the large margin of power, long hours can be run without any fear of undue heating. The set is claimed to be particularly suitable for the tropics; it has a special-dust-and-sand-proof intake cover to the carburettor. The tank has a capacity of 1½ gallons, and on normal working this is sufficient for four hours

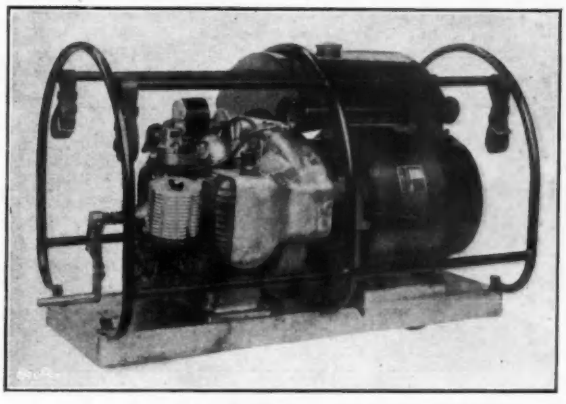


**Fig. 2.—The "Semoco" Portable Lighting Set.**

without refilling. The overall dimensions of the set are length, 33 in.; height, 21 in.; and width. 20 in. The bedplate is of cast-aluminium, and is 33 in. long and 12½ in. wide. The generator is wound for any pressure requested up to a maximum of 2,500 V at 0.6 A. It is specially designed to stand rough treatment, and when required for use where sand and dust abound a totally-enclosed machine with sandproof bearings is supplied. The armature is double impregnated and fitted with substantial ball bearings. Owing to the success of this model the makers are producing an identical machine of a smaller size. This machine will give an output of from ¾ to 1 kW, and it will be correspondingly lighter in weight and smaller in overall size.

## An Electric Hand Dryer.

Messrs. I. Calvete, Ltd., 11, Little Saint Andrew Street, Charing Cross Road, W.C.2, have recently introduced an electric hand dryer, fig. 3, which is designed for drying the hands in record time, without making use of towels. This hygienic appliance gives three jets of very strong hot-air current, enabling the hands to be dried in 30 seconds. It is claimed that due to the short drying time required, and to

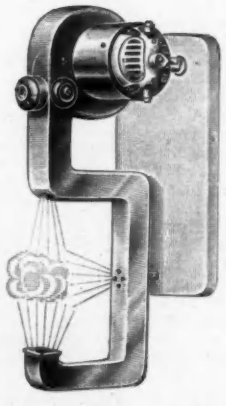


**Fig. 3.—The "Calvete" Hand Dryer.**

the fact that the hot air acts as an antiseptic, the hands will not get chapped or cracked. The loading is 1,200 watts. The apparatus is also made with the three jets placed horizontally, which design has the advantage of making the apparatus adaptable for drying the face. The dryer can also be supplied mounted on a stand with a foot control switch.

# A Large Insulator Manufactory.

**Impressions of a tour of inspection of the extensive factory and high-voltage research laboratory recently established by Steatite & Porcelain Products, Ltd., in Worcestershire.**

ESTABLISHED in 1907 for the manufacture by a patented process at Earlsfield, in South-West London, of magnesia rings and nozzles for the incandescent gas-mantle trade, Steatite and Porcelain Products, Ltd., later undertook the production in increasing quantities of electrical insulators, particularly those refractory to changes of temperature, called for by the development of electrical heating. Notwithstanding works extensions and the incorporation of the Clay Ring Co., Ltd., and W. A. Ward & Co., Ltd. (Nottingham), the business eventually so outgrew the facilities available as to render the provision of a new and larger factory inevitable.

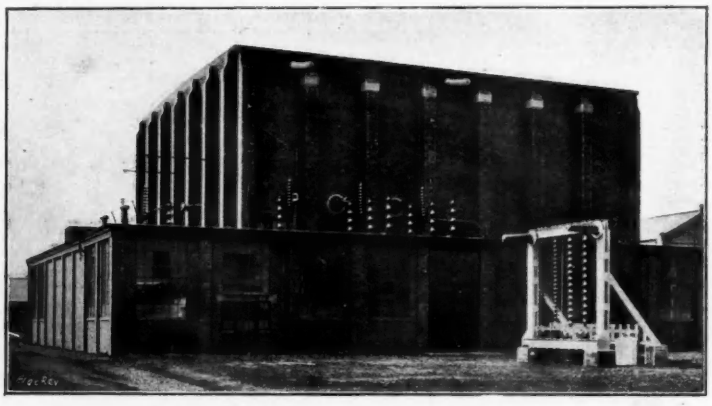


**Fig. 1.—E.H.P. Laboratory and Out-door Testing Gear.**

With that decision was incorporated the extension of the scope of the business to include the whole range of ceramic electrical insulating materials and the establishment of an adequately-equipped extra-high-voltage research laboratory, which aim has been realised in conjunction with Imperial Chemical Industries, Ltd., and Falk, Stadelmann & Co., Ltd., and with the technical co-operative assistance of the Hermsdorf-Schomburg and Steatit-Magnesia Companies of Germany. Besides an arrangement for the interchange of the results of research work, S. & P.P., Ltd., has an exclusive licence within the British Empire for the use of the many valuable insulator patents owned by those two German companies.

The 70-acre island site of the new factory at Burlish, Worcestershire, is close to the River Severn, which is navigable for 110-ton barges, and has the advantages of easy access to such distributing centres as Birmingham and Manchester, and by water to Gloucester (ship canal) and Avonmouth (Bristol docks), proximity to some of the best deposits of fireclay in England (at Stourbridge), and to a number of coal pits. The site was made available by the enterprise of the Shropshire, Worcestershire and Staffordshire Power Co. in earmarking the most desirable industrial sites in the area when it built its Stourport electricity generating station. A new railway station and sidings have been provided by the co-operation of the Great Western Railway Co. and the S.W. & S. Power Co., while with the assistance of the Ministry of Labour a contribution towards the alleviation of unemployment is being made by the training of miners from distressed coal areas to do semi-skilled pottery work, members of whose families of a workable age also being trained in various departments of the new works.

A housing estate of 300 houses, of which 142 have already been built, has been planned for the accommodation of the staff and workpeople, over 600 being already employed. Even the smallest houses, which are let at low rentals, contain two living rooms, three bedrooms, and a bathroom, electric light and hot water being provided. The estate is pleasantly situated and is to include a recreation ground, social club, and shopping facilities. A hot meal is served daily below cost in a well-equipped canteen which is capable of accommodating 450 workers. The internal steel structure of the factory is painted white, which not only facilitates the detection of rust and dirt, but also exercises a psychological effect on the employés, to whom the clear atmosphere and bright cleanliness of their surroundings appeal directly.

The first unit of the single-story factory has a floor area of over four acres, the whole having been designed to assist extension by duplication. Maximum use is made of gravity flow and conveyors to avoid the man-handling of materials, which are constantly sampled and checked for quality and quantity. The control of "body" purity is so stringent that the only means of communication between the storage and preparation buildings is through an automatic weighing machine controlled by a combination lock set by the works manager. It travels below the silos and weighs up to 2 tons of the mixture at a time with an accuracy of 0.5 lb., or 0.01 per cent.; unless the knife edges are correctly balanced for each material, corresponding to the figures of the lock, the mixture cannot be discharged through the floor to the porcelain-lined grinding mills and mixing vats below, the right propor-

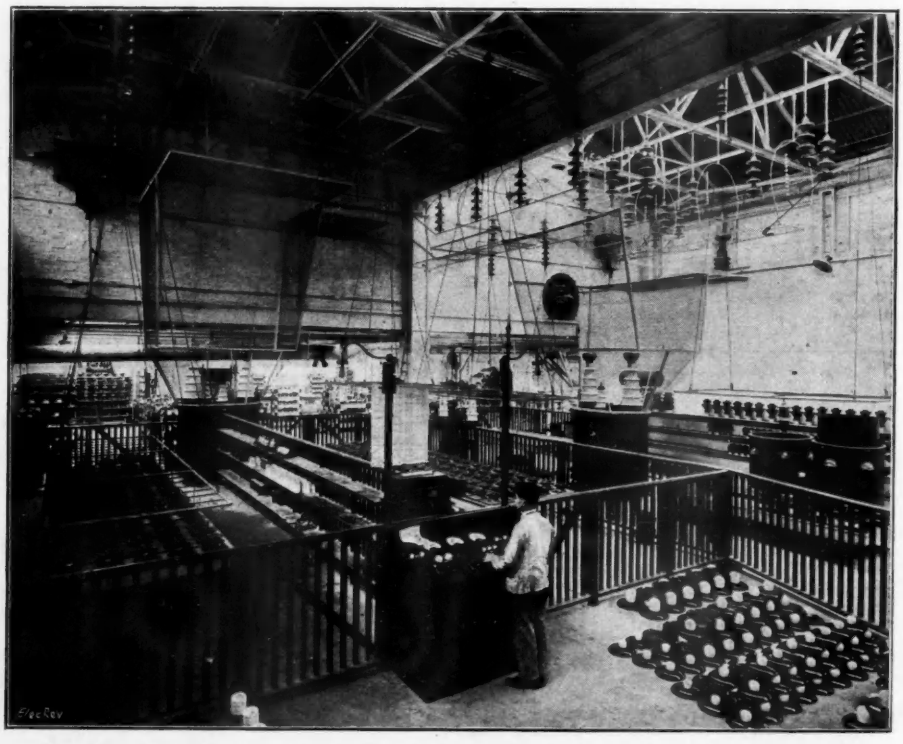


**Fig. 2.—Part of the Routine Electrical Testing Department of the Factory.**

tions of the various ingredients being thus ensured within 0.1 per cent.

Such is the thoroughness with which the processes are watched, dimensions examined and the determination of the mechanical and electrical properties of standard test pieces likewise carried out at frequent stages. So much so that steatite articles of highly intricate shapes can be dry-pressed by automatic machine-tools and supplied commercially

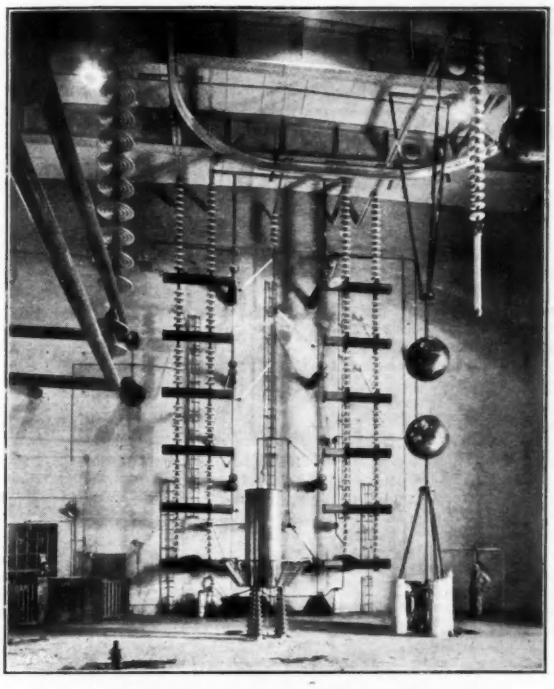


**Fig. 3.—Condenser Bank, Tesla High-frequency Transformer, and Sphere Gap.**

with a tolerance of only 2 per cent., as compared with 5 per cent. and upwards in the case of porcelain. Besides its very much greater tensile and bending strength, steatite is suitable for high-frequency work and it is also being used in Switzerland in connection with attempts that are being made there to ascertain the voltage of natural atmospheric lightning; insulation for almost 10,000,000 volts has been provided, while voltages over 6,000,000 volts is stated to have been recorded.

It will be appreciated that in the manufacture of high-voltage porcelain, the electro-mechanical characteristics of which may be profoundly affected by slight variation of composition or treatment, causes and effects must be clarified so far as is possible. Not only is the mathematical treatment of many of the problems involved exceptionally difficult, but often it is impossible without making wide assumptions. Hence the desirability of checking designs based on calculation by test determination and the provision of a generously equipped e.h.p. research laboratory, typical views of which are reproduced herewith. Indeed, the impressive up-to-dateness of the whole factory was very evident to the 300 distinguished guests of the company who last week travelled by special train from London and Birmingham, by road, and even by air, to inspect the new factory, and for whose instruction various mechanical and electrical tests were demonstrated, including the following:—

(*a*) Flashover of 22-unit suspension insulator string at 1,045,000 volts, 50 cycles per second. The two cascade-connected Ferranti transformers used, fig. 4, weigh 23 tons each, one of them being supported on six porcelain insulating columns, each 18 ft. high.

(*b*) The application of voltages in excess of 1,000,000 at 30,000 cycles per second to smooth and shedded insulators in order to demonstrate that, although the latter was considerably shorter, it prevented flashover at a considerably higher voltage than the former.

(*c*) A tensile load of 2 tons was applied to an insulator string and a vibratory load (applying 170 complete vibrations per minute) was super-imposed on it to imitate the normal working conditions of overhead lines when the conductor is caused to vibrate by wind or dropping ice.

(*d*) A tensile test to destruction of a large strain insulator was being performed; the ultimate strength of the insulator exceeded 25 tons, a strength of that order being obtained only, it is claimed, by the use of the patented spring-ring method of pin fixing.

(*e*) Porosity test on broken pieces of porcelain without glaze under a pressure of 400 atmospheres (6,000 lb. per sq. in.) in a solution of fuchsine; no penetration of the dye into the material was observable.

(*f*) Life test of an open-air isolating switch using insulators as supplied to General Electric Co., Ltd., for the Central-England electricity scheme. The switch was automatically operated by compressed air 80 times a minute, and the blade and contacts were of the kind actually used for 132-kV open-air switchgear, the stresses in the insulator posts comprising impact-torsional and impact-bending stresses.

(*g*) Bending test on a 132-kV insulator post as supplied for the Central Electricity Board.

(*h*) Impulse flashover on a standard suspension insulator string as supplied for the national grid at 1,200,000 volts. The impulse generator used, fig. 3, generates surges which rise from zero to their peak voltage in less than 1 microsecond (1 millionth second); the test imitates an actual lightning stroke on an overhead lines, and it was observed that, even at that extreme voltage, no damage to the insulators occurred. Impulse voltages up to 1,800,000 have been reached and are believed to be highest recorded in this country.

Dr. G. C. Clayton (Imperial Chemical Industries, Ltd.) presided at the luncheon in the absence of Lord Melchett, and the speakers included Sir Edward T. F. Crowe (Department of Overseas Trade), Sir Philip A. M. Nash (Associated Electrical Industries, Ltd.), Sir John R. Brooke (Electricity Commissioner). Mr. C. S. Garland (managing director, S. & P.P., Ltd.), and Mr. L. Thurner (chairman, S. & P.P., Ltd.).

Some of the first insulators produced by the company were exported last year for use in connection with the hydro-electric scheme in Palestine, and it claims to have received orders for British national grid insulators of a value of over £100,000. In the course of the speeches reference was made to the increase during the past few years of the value of Britain's export of electrical apparatus from £16,000,000 to £20,000,000, which was satisfactory, but not sufficient, since America's exports had improved in value from £16,000,000 to £24,000,000, and Germany's had grown from £14,000,000 to £29,000,000. Scandinavia, Germany, Poland, Austria, Switzerland, Italy, and France were already exporting and importing (or exchanging) electrical energy, which pointed to the gradual growth of an international network of power-transmission lines, similar to the evolution of the existing inter-state railway transportation systems. Thus the high-class insulator manufacturing industry was increasing in importance.

The German combine already did considerable business with this country and other parts of the Empire, and it had been agreed that it should give to Steatite & Porcelain Products, Ltd., a very large portion of its business with the intention that the British company should eventually satisfy the whole of the Empire's needs for insulators. The company had wisely availed itself of that help and co-operation, not only in planning and equipping its factory, but also in training its employés by skilled German workers (men and women) who had been loaned to it until such time as it could do without them.

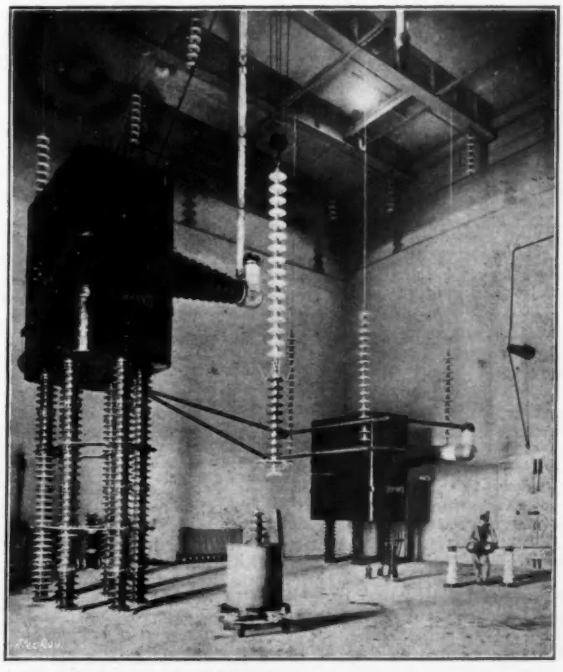


**Fig. 4.—Ferranti Million-volt Cascade Transformers.**

Lord Melchett, in a written message, expressed his strong feeling that the porcelain industry in this country had arrived at the stage at which its rationalisation would produce the maximum advantages to all concerned, and that the present was a favourable time to bring about that rationalisation. He understood that steps were being taken in that direction, and hoped that the work to which they had put their hands might be instrumental in bringing about a unified porcelain industry in this country.

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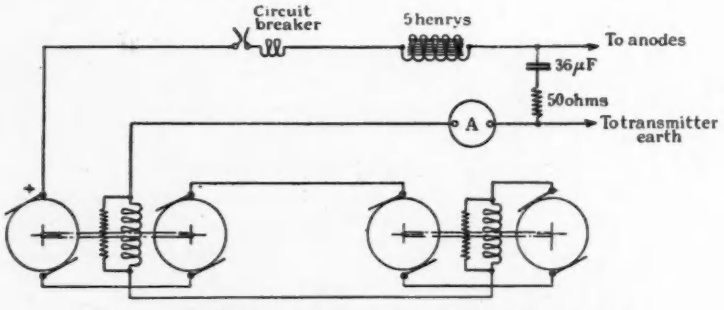


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All branches of the Association were represented at the meeting, and reports were given showing the wonderful progress made throughout the country.

The meeting was well attended, there being well over 200 people present. The chair was taken by Mrs. Wilfrid Ashley (president) supported by the officers.

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Mr. HERBERT MORRISON, J.P., M.P. (Minister of Transport), responding, referred to the tendency towards alleviating household drudgery. Nevertheless, millions of housewives still had to get up early on winter mornings to make the fires, and still had to boil hot water as and when required—all of it needlessly laborious work in the light of modern electrical service. Attractive tariffs and expanded sales organisations would be to the interest of the supply authorities as well as to their consumers; they should be satisfied by modest profits on increased turnover, rather than pursue a policy of high profits and restricted development. He, too, looked forward to the time when electricity would be available to all the homes of Great Britain, including those in rural areas. He spoke as the enthusiastic owner of an "electric" home, and he desired to congratulate Mrs. Wilfrid Ashley and Miss Haslett on the educational and pioneering work they had done with the E.A.W

The toast of the "Electrical Association for Women" was proposed by Sir FELIX POLE (chairman, Associated Electrical Industries), who referred to the energy with which the E.A.W. was run. It was fulfilling a work that men could not do. He hoped to see electricity supplied at uniform rates throughout the country, and looked to its agency for the repopulation of the country side.

The PRESIDENT, in response, referred to the use of overhead lines in Italy, and thought that in time we should notice them less in our own country. Windmills, no doubt, were at one time regarded in the same light as some people now regard overhead lines, but there was in existence an association for their preservation. Electricity in its labour-saving aspect was more necessary in the homes of people who were less well off than in those of people who could afford to employ servants.

In the afternoon a visit was paid to the Home Office industrial museum, Horseferry Road, S.W.1. This proved of great interest, and will no doubt lead to later visits by individual members who wish to take the opportunity for a closer study of some of the exhibits.

A reception in the evening by the London Executive Committee at the Institution of Electrical Engineers was followed by a conversazione and one of Mr. Llewelyn B. Atkinson's inimitable lantern-illustrated lectures on his reminiscences. As the lecturer has in the course of his career come in contact with most of the intellectual giants of the electrical industry, he was in a position to relate many revealing anecdotes of those whose names are now household words.

The visit to Messrs. J. Lyons & Co.'s factory at Greenford on Friday morning was greatly appreciated. A fitting close to a most successful Conference was provided on Friday evening by a ball and cabaret at the Park Lane Hotel, when the president received about 230 guests at a brilliant gathering, which included a large number of prominent men and women.

# Institution of Electrical Engineers.

### Annual General Meeting.

COLONEL SIR THOMAS F. PURVES (president) occupied the chair at the annual meeting of the Institution on Thursday, May 15th. There was a small attendance.

In presenting the annual report of the Council, the president drew special attention to a few items, commenting on the great increase in membership during the immediate post-war years, the number having increased from 9,449 in 1921 to 14,200 in 1930.

With regard to the Faraday centenary celebrations and the proposed expenditure of £10,000 by the Institution, the president remarked that, although that might seem to be a large sum, the Council thought the expenditure would be justified in creating interest among the public in electricity. He added that the exhibition which it was proposed to hold at the Albert Hall, London, would be of a non-advertising character.

Mr. F. W. PURSE drew attention to the small number of full members of the Institution in relation to the total, and also pointed out that there had been no addition to the number of full members during the past year, the figure being 1,959 at the beginning and remained the same after allowing for deaths, lapses, and additions. He expressed surprise that the Institution, with a full membership of 14,200 and such a large industry to draw upon, should only have 1,959 full members, and that it had not been able to increase the number during the past year. There must be many eligible for transfer to full membership, and it seemed that there were some who were not doing their duty to the industry and the Institution.

The PRESIDENT agreed that this was a very important matter, and said that the small number of full members was due entirely to the fact that proposals were not forthcoming. It was certainly a matter that should be taken in hand, and he promised that the Council would consider it.

Mr. W. C. P. TAPPER pointed out that he had only received a copy of the Council's report that afternoon, and therefore had not had time to read it carefully enough to criticise it. He suggested that copies should be available at an earlier period, and that a register should be kept of those who specially desired to have copies. With regard to the Faraday centenary celebrations and exhibition, he asked how the interest of the public in electricity could be aroused by the exhibition if it was to be of a non-advertising character. Surely some form of advertising would have to be done?

The PRESIDENT, replying to the first point raised by Mr. Tapper, said that in the notice convening the annual general meeting, which was sent round on March 13th it was stated that copies of the Council's report would be available to all who applied for them 10 days before the meeting. The suggestion to keep a register of those who regularly desired to have copies of the report was a good one, and would be considered with a view to its adoption. With regard to the Faraday centenary exhibition, what he meant when he said it would be of a non-advertising character was that there would not be advertising exhibits at the exhibition. At the

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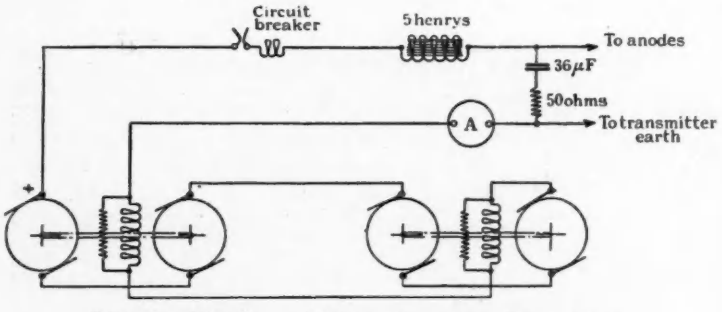


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The luncheon of the E.A.W. on May 15th at the Park Lane Hotel after the annual general meeting was attended by some 430 members and guests.

Mrs. WILFRID ASHLEY (president) gave the loyal toast, and the Rt. Hon. MARGARET G. BONDFIELD, M.P. (Minister of Labour), proposed "Electricity in the Service of Women." Miss Bondfield said that great as had been the progress in the use of electricity during the past seven years, it could not be said that its present stage represented what was possible. The retailing of electricity was still unsatisfactory, but help was to be expected from free-wiring and hire-purchase of apparatus, coupled with intelligent and well-informed publicity (such as the E.A.W. could give) and practical working (in which Miss Partridge was so outstanding an exponent). Girls should be trained to become familiar with the use of electricity, which should find its way into the most humble households. The demand for electric cooks was much greater than the supply.

Mr. HERBERT MORRISON, J.P., M.P. (Minister of Transport), responding, referred to the tendency towards alleviating household drudgery. Nevertheless, millions of housewives still had to get up early on winter mornings to make the fires, and still had to boil hot water as and when required—all of it needlessly laborious work in the light of modern electrical service. Attractive tariffs and expanded sales organisations would be to the interest of the supply authorities as well as to their consumers; they should be satisfied by modest profits on increased turnover, rather than pursue a policy of high profits and restricted development. He, too, looked forward to the time when electricity would be available to all the homes of Great Britain, including those in rural areas. He spoke as the enthusiastic owner of an "electric" home, and he desired to congratulate Mrs. Wilfrid Ashley and Miss Haslett on the educational and pioneering work they had done with the E.A.W

The toast of the "Electrical Association for Women" was proposed by Sir FELIX POLE (chairman, Associated Electrical Industries), who referred to the energy with which the E.A.W. was run. It was fulfilling a work that men could not do. He hoped to see electricity supplied at uniform rates throughout the country, and looked to its agency for the repopulation of the country side.

The PRESIDENT, in response, referred to the use of overhead lines in Italy, and thought that in time we should notice them less in our own country. Windmills, no doubt, were at one time regarded in the same light as some people now regard overhead lines, but there was in existence an association for their preservation. Electricity in its labour-saving aspect was more necessary in the homes of people who were less well off than in those of people who could afford to employ servants.

In the afternoon a visit was paid to the Home Office industrial museum, Horseferry Road, S.W.1. This proved of great interest, and will no doubt lead to later visits by individual members who wish to take the opportunity for a closer study of some of the exhibits.

A reception in the evening by the London Executive Committee at the Institution of Electrical Engineers was followed by a conversazione and one of Mr. Llewelyn B. Atkinson's inimitable lantern-illustrated lectures on his reminiscences. As the lecturer has in the course of his career come in contact with most of the intellectual giants of the electrical industry, he was in a position to relate many revealing anecdotes of those whose names are now household words.

The visit to Messrs. J. Lyons & Co.'s factory at Greenford on Friday morning was greatly appreciated. A fitting close to a most successful Conference was provided on Friday evening by a ball and cabaret at the Park Lane Hotel, when the president received about 230 guests at a brilliant gathering, which included a large number of prominent men and women.

# Institution of Electrical Engineers.

### Annual General Meeting.

COLONEL SIR THOMAS F. PURVES (president) occupied the chair at the annual meeting of the Institution on Thursday, May 15th. There was a small attendance.

In presenting the annual report of the Council, the president drew special attention to a few items, commenting on the great increase in membership during the immediate post-war years, the number having increased from 9,449 in 1921 to 14,200 in 1930.

With regard to the Faraday centenary celebrations and the proposed expenditure of £10,000 by the Institution, the president remarked that, although that might seem to be a large sum, the Council thought the expenditure would be justified in creating interest among the public in electricity. He added that the exhibition which it was proposed to hold at the Albert Hall, London, would be of a non-advertising character.

Mr. F. W. PURSE drew attention to the small number of full members of the Institution in relation to the total, and also pointed out that there had been no addition to the number of full members during the past year, the figure being 1,959 at the beginning and remained the same after allowing for deaths, lapses, and additions. He expressed surprise that the Institution, with a full membership of 14,200 and such a large industry to draw upon, should only have 1,959 full members, and that it had not been able to increase the number during the past year. There must be many eligible for transfer to full membership, and it seemed that there were some who were not doing their duty to the industry and the Institution.

The PRESIDENT agreed that this was a very important matter, and said that the small number of full members was due entirely to the fact that proposals were not forthcoming. It was certainly a matter that should be taken in hand, and he promised that the Council would consider it.

Mr. W. C. P. TAPPER pointed out that he had only received a copy of the Council's report that afternoon, and therefore had not had time to read it carefully enough to criticise it. He suggested that copies should be available at an earlier period, and that a register should be kept of those who specially desired to have copies. With regard to the Faraday centenary celebrations and exhibition, he asked how the interest of the public in electricity could be aroused by the exhibition if it was to be of a non-advertising character. Surely some form of advertising would have to be done?

The PRESIDENT, replying to the first point raised by Mr. Tapper, said that in the notice convening the annual general meeting, which was sent round on March 13th it was stated that copies of the Council's report would be available to all who applied for them 10 days before the meeting. The suggestion to keep a register of those who regularly desired to have copies of the report was a good one, and would be considered with a view to its adoption. With regard to the Faraday centenary exhibition, what he meant when he said it would be of a non-advertising character was that there would not be advertising exhibits at the exhibition. At the

same time a portion of the £10,000 (probably £2,000) would be earmarked for propaganda, because it was the intention to make a really energetic "push." The expenditure of the latter sum would, moreover, be carried out in close collaboration with the British Electrical Development Association.

The Council's report was adopted.

Captain J. M. DONALDSON (chairman of the Finance Committee) presented the annual accounts in the absence of the hon. treasurer owing to ill-health. He explained the reasons for the slightly lower credit balance for the past year, as compared with the previous year, *viz.*, £5,242 as against £6,040. For instance, there was the exceptional expenditure of £1,245 on re-decorating the lecture hall, a small expenditure on making available further space in the basement, and a number of other small items, together with a small increase in management expenses due to the growing work of the Institution. Actually with regard to assets and liabilities the Institution was about £8,000 better off than in 1928, and generally the accounts must be regarded as extremely satisfactory.

There was no discussion on the accounts, and they were adopted.

The auditors were re-elected, and the usual votes of thanks to the local hon. secretaries and officers, and the hon. treasurer of the Institution brought the meeting to a close.

The Council of the Institution has made the following awards of premiums for papers read during the 1929-30 session, or accepted for publication:—Institution premium to Mr. H. H. Harrison; Ayrton premium to Messrs. B. A. G. Churcher and A. J. King; John Hopkinson premium to Mr. L. C. Grant; Kelvin premium to Mr. T. G. N. Haldane; Paris premium to Messrs. H. A. Humphrey, D. M. Buist, and J. W. Bansall; extra premiums to Messrs. S. W. Melsom, A. N. Arman, B.Sc. (Eng.), and W. Bibby, B.Sc. (Eng.); Messrs. E. H. Smythe and E. G. Weeks; Messrs. T. W. Ross and H. G. Bell; Mr. W. West; Mr. Bernard Leggett; Mr. J. C. Prescott; and Mr. H. W. Taylor.

Wireless Section premiums have been awarded as follows:—Duddell premium to Mr. J. E. P. Vigoureux; extra premiums to Capt. P. P. Eckersley and Mr. N. Ashbridge; Mr. G. Shearing and Capt. J. W. S. Dorling.

The awards for papers read before the Meter and Instrument Section and the Students' Section will be announced later.

METER AND INSTRUMENT SECTION.—A one-day summer meeting is to be held to-morrow (Saturday) at Leamington Spa. After luncheon the spa, baths, and gardens are to be visited, and a group photograph taken. During the afternoon there is to be a motor-coach excursion to Warwick, Guy's Cliffe, and Kenilworth, returning to Leamington for tea.

DUNDEE SUB-CENTRE.—Following the delivery of the twenty-first Kelvin Lecture on May 16th by Mr. R. H. Fowler, lecturer in mathematics at Trinity College, Cambridge (Mr. G. Morgan in the chair), over 100 members took part on May 17th in an excursion to Loch Rannock, where the Grampian Power Co.'s hydro-electric works were inspected.

WESTERN CENTRE.—The week-end summer meeting (May 23rd to 26th) was to commence with the annual general meeting and declaration of ballot for the 1930-31 Committee vacancies this (Friday) evening, prior to dinner and dancing by invitation of the West Gloucestershire Power Co. On Saturday morning members are to tour places of interest in the Forest of Dean and Wye Valley or take part in a treasure hunt organised by the chairman (Mr. S. B. Haslam); or inspect the Lydney power station of the W. G. P. Co. Mr. W. R. Lysaght is to provide tea, and in the evening the Western Centre dinner and fancy-dress dancing are to be indulged in. On Sunday afternoon the Western Centre past-chairmen's golf club is to be competed for (an annual event), followed by an informal dinner and prize distribution. On Monday morning the works of Edison Swan Cables, Ltd., at Lydbrook are to be inspected (luncheon at the invitation of the company).

## Miners' Nystagmus.

The results of six months' experiments at the Tinsley Park Colliery, Sheffield, with high-candle-power electric lamps were reported upon by Dr. Ferguson at a recent meeting of the Midland Institute of Mining Engineers at Sheffield. Not only did the improved lighting result in a diminuation of the number of accidents, but the miners themselves also reported that it was a great improvement, with much less eyestrain, headache, dizziness, and other symptoms of nystagmus. Forty men, all coal-face workers, were employed on one shift, and were supplied with a special high-candle-power electric lamp, while a similar number of men were supplied with the ordinary two-volt electric lamp used at the colliery. The tests were begun in August last. The men with the special lamps showed a marked improvement in general health, so far as nystagmus symptoms were concerned. Mr. Ensor, the manager of the colliery, said that, although the special Wolf lamp was about 3¼ lb. heavier than the lamp in general use, the men did not object to the extra weight, because of the advantages of the extra illumination, and wished to retain the new lamps. So far as the output per man was concerned, there was little difference between the two shifts, but the difference in the accident rate was marked, the total number among the men with ordinary lamps being 21 and among those with new lamps 12.

# Reviews.

**Overhead Power Lines.** By Captain W. MORECOMBE, R.E., B.Sc., A.M.I.E.E. Pp. xi+236; figs. 17. London: Chapman & Hall, Ltd. Price 15s. net.

In this book there are eleven short chapters ending at page 199, then followed by four Appendices treating with the Post Office and the Electricity Commissioners' Regulations.

According to the author, the objects of the book are to present certain constructional data and to explain the elementary features of design in a manner helpful to the beginner. The objects are helpful, though incomplete, as can be expected. Various constructional features of overhead power lines are quite sparingly discussed, a little over four pages covering the subject of "ferro-concrete" poles of one type, which happens to be one of the many existing patent-void types. The electrical features cover no more than a space of eight pages, and in the short discussion there would appear to be confusion in the author's mind as to the inductance and coefficient of self-induction of a circuit.

The author says he offers no apology for repeating the words "approx." and "roughly" in the text matter; in fact he attempts to qualify his remarks by the expression "a good deal is conjectured." Such remarks tend to weaken the author's objects.

This book is of the publishers' well-known standard style and quality. It should find a field along with Chapman & Hall's other books on the subject of overhead power transmission.

**Television To-day and To-morrow.** By SYDNEY A. MOSELEY and H. J. BARTON CHAPPLE. Pp. xiii+130; illustrated. London: Sir I. Pitman & Sons, Ltd. Price 7s. 6d. net.

A book giving adequate working details of the Baird system of television has long been awaited by those interested in this entertaining subject, and this book purports to do so, and does not hide the fact that it attempts very little besides this. Television receivers working on the Baird system have now been placed on the British market, and to the many who will desire to judge for themselves the stage of progress reached to-date, before considering whether to purchase now or wait, with what patience they may, further developments of the science, this book should be invaluable.

In the Foreword Mr. Baird now admits that the ten-kilocycle waveband of the London Regional Broadcast Transmitter is too narrow to afford adequate scope for television, as it imposes a restrictive limitation to simple scenes, owing to the absence of much detail, but he emphasises that television in practice is not bound by the same laws as kinematography.

The Introduction admits embarking upon a dangerous venture, and proceeds to propound an entertaining theory of an electrical nature, regarding the process of thought as carried on by the human species.

A history of television is started (Chapter I), but digresses by setting out the various claims as to Baird being the pioneer in the realms of the several possible developments of television, such as stereoscopic, three-colour, infra-red, &c., apparently without regard to the greater merit deserved by those who eliminate the complications of a purely laboratory success and achieve the stage of practicability by simple means. The necessity for this is conceded in Chapter II, and a lucid explanation of general principles is given, followed by an appeal to amateurs for their co-operation, and late as this is, it is unlikely to be in vain.

The Baird transmitter is fully described (Chapter III), with an explanation of the limiting of detail due to the narrow waveband at present available in broadcasting. The author urges the need for a band of the order of twenty kilocycles in place of the present nine (effective) kilocycles.

A description of the Baird receiver is detailed (Chapter IV), followed by valuable instructions for dealing with the minor difficulties met with in operating, and a number of reproductions of the image as seen in the Televisor are also shown, which give a fair idea of the results now obtained under practical working conditions. While these show that there is ample room for improvement, they give a good promise for the future.

The importance of simple yet efficient means of obtaining synchronism is made clear (Chapter V), and Baird's ingenious new system is explained in fair detail, followed by a cursory description (Chapter VI) of photo-electric cells and neon lamps, with one or two examples of the circuits in which they can be utilised. The essential requirements of a wireless receiver to be used for television reception are lucidly discussed (Chapter VII), and vital information for the amateur constructor is given.

Broadcast television will probably become established by making good use of films, thus providing interesting subjects for transmission, and the "tele-kinema" and "tele-talkie" are discussed briefly (Chapter VIII), but the attitude of Baird toward their use, as there alleged, is difficult to justify, in view of the comparative ease in transmitting a transparency. No mention is made of the transmission, by means of sound films, of the visual and sound effects, both by the same wireless channel, by scanning the full width of the film and converting the recorded sound portion at the receiving end.

The utilisation of infra-red rays, and the adaptation of television methods for the penetration of fog by their use, is

outlined (Chapter IX), continuing with an account of transmission with daylight scanning (Chapter X) and of the method of recording images by means of wax records, together with the reproduction therefrom of the visual effects recorded.

Colour and stereoscopic television is briefly dealt with (Chapter XI), while the final chapter, giving a desultory account of the efforts of workers in other countries, is likely to mislead by reason of important omissions.

The book as a whole is founded upon, and practically limited to, the work of Baird and those directly associated with him, is lucidly written, and is comparatively free from mistakes—except, perhaps, for several mistaken views. The illustrations are good, well chosen and interesting, while the diagrams and sketches are numerous and clear, but more details are desirable in some instances.

There is much that might well have been omitted without detracting from the best use of the book, while certain subjects such as photo-electric cells and neon lamps are worthy of fuller treatment, with more than the scant working data given; but, notwithstanding, the book will be welcomed, if only for the information contained in Chapters IV V and VII. Although the information given upon the construction and operation of television receivers appears to be based entirely upon the use of components marketed by the Baird Company, the users of all television apparatus, and particularly amateur constructors, would be wise to have this book ready to their hand; it is well worth careful perusal by anyone interested in this entertaining subject.

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**The Theory of Electrical Artificial Lines and Filters.** By A. C. BARTLETT, B.A., Member of the Research Staff of the General Electric Co., Ltd. Pp. ix+155; 160 figs. Chapman & Hall. 13s. 6d. net.

**Transmission Networks and Wave Filters.** By T. E. SHEA, M.S., Member of the Technical Staff, Bell Telephone Laboratories. Pp. xvii+470; 263 figs. Chapman and Hall. 32s. net.

In view of the rapid developments which have taken place, and are still taking place, in the methods of telegraph and telephone transmission, these two works by American authors will be read and studied with interest by British telegraph and telephone engineers. In the former of the two volumes the author deals with the general theory of artificial lines and filters, including ladder networks, uniform telephone or transmission lines, coil-loaded telephone cable, homographic transformation, and the theory of the multi-stage thermionic-valve amplifier.

The work is practically wholly mathematical, and the student who has previously gone through Kennelly's work on artificial lines will find much with which he is already familiar.

In Chapter 5 some interesting methods of approximation in the determination of equivalent lines and networks are given, and attention might be directed to paragraph 39, in which the author deals with the case of the remarkable artificial line which has the property of equalising both attenuation and phase angle in a uniform line; or, in other words, a complete distortion-correcting artificial line.

A set of examples and notes is given at the end of each chapter in order to illustrate particular cases of what has been treated in a general form.

In the second and larger volume, the author gives an extensive presentation of the calculation and design of networks and wave filters, based on the practical experience and research of the Bell Telephone Laboratories. Originally intended as "out of hour courses" in the company's laboratories, the material was subsequently revised for presentation to the Massachusetts Institute of Technology. The author, however, does not claim originality for the subject matter, but rather desires it to be regarded as a synthesis of the contributions of a large number of scientists connected with the Bell system. In the introductory chapter the place of transmission networks in communication systems is fully discussed, and the four following chapters (constituting Part I) deal with the fundamental principles of electrical-circuit theory, conditions for network equivalents, effect of impedance mismatched at the terminals of a network, properties of 2-terminal impedance arms, &c. Part II is devoted to electric wave filters, and occupies six chapters dealing, respectively, with conditions for free transmission and attenuation, the more common types of filter sections, low pass, high pass, band pass and band elimination types, terminal effects and interacting losses, resolution of steady waves into frequency components by Fourier Series analysis, and the resolution of transient waves into frequency components by Fourier integral analysis.

As in the case of the former volume, the text is largely mathematical, but in every case the detailed treatment is preceded by explanations of the electrical and mathematical theory involved. Not the least important section of the work is the brief portion of the introductory chapter in which the author discusses the engineering limitations on network designs and construction—a subject which has already received attention in this country by Beer and Little.*

Throughout the volume the author makes constant use of the "decibel" and "bel" in substitution of what is known as the "transmission unit" (T.U.) used in the measurement of line losses. Whether this nomenclature will meet with general acceptance in this country remains to be seen, but considerable space is devoted to its definition and application, both in the text and in an appendix.

An exceptionally extensive bibliography of works dealing with networks and wave filters is given in appendix A. The two volumes, which are excellently printed and very fully supplied with diagrams and curves illustrative of the text, will undoubtedly be of much use to those engineers who are occupied with present-day problems of speech transmission, television, telephotography, &c.

* *Vide* I.P.C.E.E. *Journal*, January, 1925.

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**Electron Physics.** By J. B. HOAG, Ph.D.. Pp. ix+208; illustrated. London: Chapman & Hall, Ltd. Price 15s. net.

Electron Physics, according to the preface, is the outgrowth of a laboratory course in radioactivity and the electric discharge through gases, given at the University of Chicago, initially by Prof. A. J. Dempster, and later by the author. It is divided into eight main sections—each giving a statement of essential theory followed by experiments—five appendices on matters of technique, a few problems, and the usual tables.

The first chapter introduces modern ionic work by the historical path of the passage of electricity through dense gases; it is brief, but to the point, and furnishes a logical basis for the subsequent use of many instruments based on the accompanying phenomena. Chapter 2 deals with the electron, its relation to the electrochemical equivalent, Avogadro's number and the charge of the alpha particle, and the exact determination of its charge by means of X-rays—the work of Bearden—the fluctuations in the filament emission of a thermionic valve and charged oil drops; the one experiment described, which is to be done by the student, is the use of Millikan's drop method for determination of $e$. The apparatus described for this is both simple and exact, and there is no reason why it should not be used in all advanced teaching laboratories. Chapters 3 and 5 deal with thermionics, photo-electricity and critical potentials; the number of experiments which could have been introduced in illustration of the principles of diodes, triodes and tetrodes is of course legion, and little new will be found, except possibly in the determination of critical potentials of gases with soft valves prepared in the laboratory, and probably in the introduction of the photo-electric cell for class work. The intermediate chapter (4) is the best of the whole book, and treats principally of the determination of e/m for the electron, and with the wave-nature of the electron. Two experiments for finding the values of e/m and of the velocity are given in detail, one the direct magnetic deflexion method, and another the Busch method. In the forms given they will almost certainly be new to most English readers. Chapter 6 is a short account of the discharge of electricity through gases at low pressures, and includes a reference to Langmuir's method for finding the space-potential (also the inaccurate statement that the negative glow has a positive space-charge). Chapters 7, 8, and 9 are on radioactivity and the absorption of various types of radiation, and the appendices on electrical instruments and vacuum technique.

There is, so far as is known by the reviewer, no other book of this type in existence. The number of courses similar to that outlined at present extant cannot be large, and it is admittedly difficult to see where room for such can be found in current curricula, with the usual poor standard for admission to laboratories. Dr. Hoag and Prof. Dempster have provided in this book a powerful argument for a radical change in this matter, and the writer is to be congratulated on a valuable and suggestive volume.

K.G.E.

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# Correspondence.

***Correspondents should forward their communications as early as possible.*** *No letter can be published unless we have the writer's name and address in our possession.*

## Conditions in Spain.

"Spain's" inquiry in the ELECTRICAL REVIEW for March 28th regarding conditions in the Peninsula has only just come to my notice. Five years' experience in Spain convinces me that the man who comes here to seek a job has to accept less than half the salary he would receive were he sent out from home to fill the same post. Moreover, he would be paid in local currency, and its continual fluctuations are likely to be a source of worry, if he wishes to send any money home.

The cost of living varies in different towns, but for a Britisher it is about the same as at home, although a Spaniard can live well on a good deal less.

With regard to electrical firms operating in Spain, there are British Chambers of Commerce in Madrid, Barcelona, &c., and no doubt information could be obtained from them through their associated bodies at home.

There must be good business to be had here, and it is significant that there are ten times as many Germans on the ground looking for it as there are British. It is a pity that British firms are so apathetic and do not realise that Spain to-day is a very different place from what it was five years ago. Even the I.E.E. makes no serious attempt to fill its vacancy for an honorary secretary for Spain.

*May 14th, 1930.* **Madrid.**

## Automatic Electric Kettles.

We would like to refer to the article by "A Consumers' Engineer" which appeared in your issue of May 2nd under the heading of "Some Points Regarding the Construction and Maintenance of Electric Kettles."

The writer condemns an electric kettle in which the automatic cut-out device is actuated by the movement of the kettle bottom under the influence of heat because:—

(*a*) To get the desired movement, the kettle bottom has to be dished, resulting in relative movement between the kettle bottom and the elements, which does not improve the life of the latter.

(*b*) The distortion of the bottom under normal conditions of use may be sufficient to cause the cut-out to function prematurely, or distortion in the other direction may prevent its functioning when it should.

Speaking as the designers and manufacturers of the particular type of kettle referred to, we can only conclude that "A Consumers' Engineer" has assumed that such defects are likely to occur without having proved that they actually happen in practice.

Referring to (*a*), there is no evidence in the case of our dished bottom kettle (Met.-Vick. type), to show that there is any detrimental relative movement between the kettle bottom and the elements. It should be noted that there is a certain amount of relative movement due to inequality in expansion, whether the kettle-bottom be flat or dished.

In the case of the flat-bottom type, the stresses set up in the metal, by heat action, together with the inequality of expansion of the element pressure plates and the kettle bottom, frequently causes the latter to buckle, which eventually causes the element to burn out.

In the case of the dished bottom, the possibility of such distortion is neutralised by reason of the fact that the whole heat bottom expands uniformly in one direction, *i.e.*, inwards, thus preventing all possibility of buckling. The remaining factor, *i.e.*, the slight inequality in expansion of the kettle bottom and the specially curved element pressure plates, is insufficient to cause element trouble, and such inequality is markedly less in the case of the dished bottom.

Regarding (*b*), any tendency for the dished bottom to assume a slight permanent distortion inwards, due to the kettle being continually boiled dry, is counteracted by a carefully calculated tolerance in the setting of the cut-out. Experiments have shown that it is possible to boil the kettle dry 1,000 consecutive times without affecting the action of the cut-out. This guards against the premature action of the cut-out. Similarly, the tolerance allows for any slight tendency to premature action of the cut-out due to excessive furring when very hard water is used, which has the effect of overheating the bottom. A similar tolerance in the reverse direction counteracts any tendency towards a retarding of the cut-out action. The cut-out is set at the factory to operate in 25 seconds from the time of switching on the current when the kettle is perfectly cool and dry. It is perfectly safe, however, if the cut-out acts between 20 to 30 seconds.

The author also states that it is a disadvantage for the circuit to be broken by the cut-out device ejecting the connector; first, because the latter with live sockets is thrown off and may be left lying about within reach of children. This objection should never be possible, since the design of connector should make it impossible, as in the case of the particular kettle already referred to. Secondly, it is suggested that the ejection of the connector may damage crockery on the table. This is an objection we have often heard made, but it very rarely happens in actual practice, and then never more than once.

Our comments are based on actual experience after selling over 20,000 "Met.-Vick." automatic kettles, since their introduction less than two years ago. Not one supply authority who previously hired out the fusible-plug type of kettle has reverted to that type after using our kettle, owing to the lower maintenance costs of the latter.

This actual experience is contrary to "a Consumers' Engineer's" conclusion that the fusible-plug type of kettle is the better on points all round.

**Metro-Vick Supplies,**
P. M. EDINBOROUGH,
*Manager, Domestic Appliance Dept.*

London, W.C.2, *May 14th*, 1930.

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## X-ray Kinematography.

May I point out that the article by Dr. A. Salmony relative to the excellent work of Dr. Gossheimer on X-ray Kinematography in your issue of April 25th takes no cognisance, either of recent work in France and Great Britain, or of earlier work in Germany.

With a view to the maintenance of that historical perspective which shows how most improvements are brought about little by little, I append a bibliography which may be of use to some of your readers.

1. A. Hasselwander. "Die Bedeutung des Röntgenbildes für die Anatomie." "Erg. der Anatomie u. Entwicklungsgeschichte," 1921. Vol. 23, pp. 652-3.

2. A. Lomon and J. Comandon. Extract from "Comptes rendus des séances de l'Académie des Sciences." March 17th, 1924, t. 178, p. 997. "Bulletin de l'Académie de Médicine." June 3rd, 1924, t. XCL, No. 23. "Journal de Radiologie et d'Electrologie." October, 1924, No. 10. "Recherches et Inventions." June 15th, 1924, No. 17.

3. Russell J. Reynolds. "British Journal of Radiology." January, 1927, vol. XXIII, No. 90.

4. F. Melville. "British Journal of Radiology." July, 1927, vol. XXIII, No. 92.

**H. A. Harris,** M.B., B.S., D.Sc.

London, W.C.1, *May 14th*, 1930.

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## Worm-geared Lifts.

It would seem from Mr. J. T. Towlson's letter on the above subject, that all high class lifts should have as one of their essential features a high-lead worm. I wish to dispute this point.

I agree with the lecturer to whom Mr. Towlson refers, inasmuch as worm drives are particularly suited for lift work, as they can be designed to be self-sustaining, as well as for their other features. I know at least one high-class firm of lift makers considers the self-sustaining feature as being important; it advertises its lifts as being self-sustaining, even when the cage is overloaded. The reason for this is, no doubt, that the safety of the lift should be given preference to the small saving in energy consumption obtained by using a high lead, *i.e.*, high-efficiency worm. Presumably by "high class" lifts Mr. Towlson means high efficiency.

It is the common knowledge of all engineers—I hope—that if the efficiency of a machine exceeds 50 per cent. it will overhaul, hence to ensure a worm gear being self-sustaining its efficiency must be low. Taking the particular case a worm gear will overhaul if the thread angle $\theta$ is greater than the angle of friction ($\phi$), *i.e.*, if lead/pitch = circ./tan $\phi$.

There are cases where it is imperative to use high-lead worms, as with high-speed lifts, by which I do not mean that there are no other more satisfactory methods of operating these lifts.

I would suggest that in the case of the 75-kW lift the "lift expert" was temporarily absent-minded, as I feel sure that no lift expert would dismantle the brake without first ascertaining whether the lift was self-sustaining.

In conclusion, I should like to ask Mr. Towlson if he could give other points of interest in connection with this exceptional lift which requires a 100-h.p. motor to operate it.

**H. Turner.**

Rugby, *May 15th*, 1930.

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## Electric Cable Jointing.

It is extremely gratifying to me to read the remarks of Tillietudlem on "The Art and Craft of Cable Jointing" in your issue of the 16th inst. Such appreciation as that is the chief reward a technical writer receives.

**C. G. Watson.**

Welwyn Garden City, *May 5th*, 1930.

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## The B.E.A.M.A. and the Universities.

I am at a loss to understand the evidence upon which Mr. W. F. Dunton has based the statements contained in the second paragraph of his letter in your issue of May 16th. If he means that the Universities have refused to adopt the symbolic method to the exclusion of all others, it will be easy to justify their action, since there are many problems to which the Steinmetz system is either inapplicable or too complicated to be useful. But if he means that the symbolic method has been neglected by the Universities, I think he must be writing without knowledge of the following facts.

As long ago as 1904, I used the notation extensively in the advanced courses at the Central Technical College, with the full approval of Professor Ayrton; and this was certainly continued up to 1908. On removing to Manchester, I again introduced the use of the Steinmetz method, and some of the pitfalls occurring in connection with it led Dr. Smith to join with me in the publication of "Vectors and Vector Diagrams" in 1909. Certainly, for the next five years, no degree student left the Manchester College without a full knowledge of this system. At Birmingham the same procedure has been adopted, but pushed much further, so that with the first introduction of alternating current problems the symbolic method is taught, and the students use it easily during the last two years of their course—but not to the exclusion of other methods. If Mr. Dunton cares to look at past examination papers of any of these three Universities, he will find questions set which specifically stipulate a solution by symbolic algebra.

Although, as will be seen from the facts given above, I regard the system as a powerful method for the solution of problems involving harmonic variation, and especially where the fundamental only is entailed, I should not cross swords

with any teacher who preferred the trigonometrical, exponential, or other means of expressing the same equations. The fact is that if a method of solution is made too easy and mechanical, it is apt to hide the real nature of the problem, and from this point of view the Steinmetz notation has great dangers.

**William Cramp.**

Birmingham, *May 19th*, 1930.

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Mr. Dunton errs in suggesting that I do not appreciate his method; when I stated that it failed I did not imply that it failed completely, but only in so far as it had to be successively reapplied in contradistinction from the rule I quoted which is explicit.

I agree that the two rules are statements of the same case, but, whereas Mr. Dunton's needs the proviso that $f'(x)$ and $f''(x)$ both vanish, the other one is general and seems to me more precise.

**B. Wood.**

Dundee, *May 18th*, 1930.

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### Low-speed Meters.

Having tested some thousands of low-speed meters, I think they have several advantages over the fast-running meter. First, there must be less wear of bearings, jewels, &c., if the weight of the rotor is the same. As regards testing difficulties (if any), owing to the great inertia of the disk in this type of meter, revolution counting is more accurate for calibration purposes. A big advantage is to have the rotor disk graduated and numbered into 100 divisions; then if a method of testing is adopted on the following lines a high accuracy is obtainable.

| | Standard meter. Dial reading in revs. (Disk with 100 divs.) | |
|---|---|---|
| Meter under test : revs. counted. | | Time taken. |
| Full load : 50 revs. | 50.00 | About 4 mins. |
| 1/10 load : 5 revs. | 5.00 | Ditto. |

Whole revolutions read on dials; decimal part read on disk.

As mentioned before, meters with low speed and great inertia come to rest immediately a testing switch incorporated in the volt circuit is opened. Therefore an accuracy of 1 in 500 at 1/10 load is easily obtainable.

**S. H.**

*May 17th*, 1930.

[Will Mr. E. R. Gilbert West kindly send us his address.—EDS. ELEC. REV.]

# Published Specifications.

### 1928.

30,148. "Loud-speakers." Dynamic Unit Corporation of America. May 28th, 1928. (312,603.)

30,213. "Method and means for electrically heating metals." F. W. Thompson. October 18th, 1928. (328,270.)

30,421. "Apparatus for use in supplying current to electric motors and like apparatus." C. T. De Camargo and C. Bellanca. October 20th, 1928. (328,271.)

30,911. "Apparatus for television and for recording and reproducing pictures and the like." G. W. Walton. October 25th, 1928. (Cognate application, 3,663/29.) (328,286.)

33,669. "Method and apparatus for the joint application of galvanic currents and diathermic currents for therapeutical and industrial purposes." Dr. A. Varges. December 8th, 1927. (301,899.)

36,888. "Temperature-responsive inductances." British Thomson-Houston Co., Ltd. December 13th, 1927. (302,245.)

37,261. "Pneumatic blow-outs for electric switches." Allgemeine Elektricitäts Ges. December 15th, 1927. (302,603.)

37,719. "Telephone systems." Standard Telephones and Cables, Ltd., and J. H. E. Baker. December 20th, 1928. (328,314.)

38,004. "Terminal-repeater device for the reproduction of sound independent of frequency." M. Von Ardenne. Doember 22nd, 1927. (303,020.)

### 1929.

1,366. "Electric switchgear." Switchgear and Cowans, Ltd., and G. H. Neep. January 15th, 1929. (328,249.)

1,509. "Electrical illuminating apparatus." L. A. Ramsden. January 16th, 1929. (328,201.)

1,713. "Electrical inductances." London Electric Wire Co. & Smiths, Ltd., and W. F. Boyd. January 17th, 1929. (328,279.)

1,739. "Electric steam generating plant. W. D. M. Lloyd. January 18th, 1929. (328,203.)

1,772. "Watertight electric instantaneous and time blasting fuses and method of producing the same." W. Eschbach and F. Habbel. April 24th, 1928. (310,364.)

1,775. "Telephone systems." Standard Telephones and Cables, Ltd., and T. S. Skillman. January 18th, 1929. (328,206.)

1,910. "Electric discharge relay devices." Westinghouse Lamp Co. February 7th, 1928. (305,574.)

2,073. "Electric discharge tubes." S. G. S. Dicker (Naamlooze Vennootschap Philips' Gloeilampenfabrieken). January 21st, 1929. (328,227.)

2,074. "Automatic switches for use in telephone or like systems." Associated Telephone and Telegraph Co. January 27th, 1928. (304,773.)

2,075. "Switch mechanisms for use in telephone or like systems." Automatic Telephone Manufacturing Co., Ltd., and S. R. Smith. January 21st, 1929. (328,228.)

2,078. "Electrically controlling the operation of railway points." Westinghouse Brake and Saxby Signal Co., Ltd. April 17th, 1928. (309,906.)

2,133. "Electromagnetic devices for use, for example, in the recording or reproduction of sound." Graham Amplion, Ltd., and W. J. Rickets. January 22nd, 1929. (328,231.)

2,134. "Electromagnetic devices for use, for example, in the recording or reproduction of sound." Graham Amplion, Ltd., and W. J. Rickets. January 22nd, 1929. (328,232.)

2,347. "Acoustic devices." Electrical Research Products, Inc. March 31st, 1928. (308,776.)

2,748. "Call-recording apparatus for use in telephone systems." J. F. Pollak (Associated Telephone and Telegraph Co.). January 26th, 1929. (328,324.)

2,749. "Call-recording apparatus for use in telephone systems." J. E. Pollak (Associated Telephone and Telegraph Co.). January 26th, 1929. (328,325.)

2,922. "Thermionic amplifiers for use with electric gramophones and the like." N. W. McLachlan. January 28th, 1929. (Cognate application, 5,785/29.) (328,331.)

3,460. "Timing apparatus, particularly for use in connection with telephone systems." Automatic Telephone Manufacturing Co., Ltd., and J. E. Ostline. February 1st, 1929. (328,340.)

3,704. "Electric circuit-interrupting devices." British Thomson-Houston Co., Ltd. February 4th, 1928. (305,480.)

3,842. "Telephone instruments." Siemens Bros. & Co., Ltd., and W. E. Goodwin. February 5th, 1929. (328,348.)

5,779. "Electric remote-control installations." Siemens & Halske Akt. Ges. February 27th, 1928. (Addition to 280,562.) (306,953.)

7,347. "Rubber-covered electric cable." Siemens-Schuckertwerke Akt. Ges. March 7th, 1928. (307,429.)

7,682. "Electromotors especially applicable to the driving of gyroscopes." S. G. Brown. March 8th, 1929. (328,378.)

8,678. "Induction electric motors." M. Surjaninoff. March 28th, 1928. (308,734.)

8,699. "Electrically-operated automatic delivery machines." C. Hänel. March 18th, 1929. (328,391.)

9,083. "Device for the elimination of interference in the reception of wireless-telegraphy and telephony." Lowe-Radio Ges. and M. Von Ardenne. March 21st, 1928. (308,312.)

12,619. "Electric interlocking plants for the control of railway signals." Telefonaktiebolaget L. M. Ericsson and T. Hard. April 23rd, 1929. (328,433.)

13,035. "Sparking plugs for internal-combustion engines." H. J. Linse. April 26th, 1929. (328,441.)

13,049. "Electric control for the steering gear of ships and the like." Siemens-Schuckertwerke Akt. Ges. May 19th, 1928. (Addition to 293,031.) (312,058.)

13,213. "Incandescent electric lamps." G. Main. May 3rd, 1928. (310,929.)

13,228. "Mounting arrangements for automatic telephone switches and other apparatus." Siemens Bros. & Co., Ltd., and D. A. Christian. April 29th, 1929. (328,444.)

13,682. "Apparatus providing a single control for different variable regulating elements, chiefly applicable to wireless stations for various electrical and other purposes." M. Michel. May 2nd, 1928. (310,890.)

13,973. "Electromagnetic devices for use, for example, in recording or reproducing sound." Wireless Music, Ltd., and A. G. Ionides. May 4th, 1929. (328,450.)

13,976. "Construction of photo-electric cells." G. B. Ellis (Soc. des Usines Chimiques Rhone-Poulenc). May 4th, 1929. (328,451.)

15,219. "Electric circuit breakers." Associated Electrical Industries, Ltd. May 19th, 1928. (312,074.)

15,701. "Vent plugs for electric cells." Batteries, Ltd., and M. Dybeck. May 21st, 1929. (328,473.)

15,988. "Electric high-tension condenser-type bushing insulators." R. Schroeder, M. Schroeder, S. Levis, R. Levis, S. Levis, and Dr. E. Jaroslaw (trading as Jaroslaws Erste Glimmer-Warenfabrik in Berlin). May 24th, 1928. (312,323.)

16,290. "Piezo-electric crystal oscillator systems." Kolster-Brandes, Ltd. May 26th, 1928. (312,581.)

16,975. "Electric mincer." G. S. Foster. June 4th, 1929. (328,483.)

17,010. "Electric and other lighting fittings." A. P. Rutherford. June 4th, 1929. (328,484.)

17,609. "Methods of and means for radio broadcasting." C. Lorenz Akt. Ges. June 9th, 1928. (313,176.)

17,771. "Method and apparatus for the electromagnetic reproduction of sound." J. B. Fagan. June 9th, 1928. (313,406.)

18,005. "Synchronous electric motor systems." A. Karolus. June 13th, 1928. (313,524.)

18,048. "Radio system for aerial navigation." Kolster-Brandes, Ltd. June 12th, 1928. (313,500.)

19,511. "Electrical sound box for talking machines." A. M. Newman and J. Suchomski. June 25th, 1929. (328,497.)

21,698. "Electrically-driven machines for cutting out material." E. Hoogland. July 15th, 1929. (328,508.)

22,615. "Radio system for aerial navigation." Kolster-Brandes, Ltd. August 8th, 1928. (317,006.)

23,415. "Electrical relays." General Railway Signal Co. September 12th, 1928. (318,916.)

26,423. "Mercury-vapour rectifiers." Akt. Ges. Brown, Boveri et Cie. August 31st, 1928. (318,260.)

26,887. "Transformer cores." British Thomson Houston Co., Ltd. September 4th, 1928. (318,524.)

28,946. "Electricity meters." Allgemeine Elektricitäts Ges. September 26th, 1928. (319,696.)

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5,667. "Talking machines and loud-speakers." W. G. Jeffery and W. J. Jeffery. January 22nd, 1929. (Divided application on 327,776.) (328,237.)

# Trade Mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from May 14th :—

Anacos. No. 510,823. All goods in Class 5.—London Electric Wire Co. and Smiths, Ltd., 7, Playhouse Yard, Golden Lane, E.C.1.

C.C.A. Silovac ((lettering and design). No. 505,143. Class 6. Electric vacuum cleaning machines.—C.C.A. (Vacuum Cleaners), Ltd., 324, Gray's Inn Road, W.C.1.

Truphonic, Cathedral Toned Radio (lettering and design). No. 501,039. Class 8. Instruments and apparatus for use in radio-telegraphy and telephony.—Truphonic Radio, Ltd., Hanover Park, Peckham, S.E.15.

Western Electric Sound System; The Voice of Action (lettering and design). Nos. 509,184, 509,185, 509,186, and 509,187. Class 8. Recording and reproducing apparatus for sound kinematograph films.—Western Electric Co., Ltd., Bush House, Aldwych, W.C.2.

Solex. No. 509,838. Class 8. Radio-telephonic apparatus, &c.—British Homophone Co., Ltd., 67-69, City Road, E.C.1.

Tetraphone. No. 511,131. Class 8. Thermionic amplifiers for use in conjunction with submarine and other cables.—Telegraph Construction and Maintenance Co., Ltd., 38, Old Broad Street, E.C.2.

Kent's. No. 511,258. Class 8. Apparatus for recording at a distance by means of electricity the readings of fluid meters, &c.—George Kent, Ltd. 199-201, High Holborn, W.C.1.

Colossus. No. 511,904. Class 8. Philosophical and scientific instruments and apparatus for useful purposes.—Lissen, Ltd., Worple Road, Isleworth, Middlesex.

T-Diazed. No. 511,118. Class 13. Electrical switches (ordinary), plug boxes, distributor boxes, electric fusible cut-outs, &c.—Siemens-Schuckertwerke Gesellschaft, Berlin. (British representatives: Haseltine, Lake & Co., 28, Southampton Buildings, Chancery Lane, W.C.2.)

Beacon. No. 509,713. Class 50. Moulding powders made from synthetic resin, electrical insulating substances, electric insulators, &c.—Streetly Manufacturing Co., Ltd., Aldridge Road, Streetly, Staffs.

# New Work for Contractors.

**Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.**

***Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.***

BARNSLEY.—Church and schools, Silkstone Common; J. R. Wilkinson, architect, Regent Street.

BARNSTAPLE.—Theatre and cinema, with electrical work, for the Savoy Theatre (Barnstaple), Ltd.; J. Arbuthnot Lawrence, architect, Cardiff.

BEDWORTH.—Housing scheme (66) for the U.D.C.; P. G. Lee, builder, Stoke Golding.

BIRKENHEAD.—Dock; Mersey Docks & Harbour Board.

BIRMINGHAM.—Houses (4,171), Corporation estates; G. Stubbings, W. Edwards, Contractors, Ltd., Henry Boot and Sons, Ltd., W. J. Simms, Sons & Cooke, Ltd., and Jones & Spencer. Police station (£70,000); city engineer.

BLACKPOOL.—Bank, Lytham Road, South Shore, for Union Bank of Manchester; H. Wade, architect, 2, Birley Street.

BOOTLE.—Housing scheme (100); borough engineer, Town Hall (deposit £2 2s.).

BRADFORD.—Houses (100), Wisbey; R. J. Patchett, Ltd.

BRISTOL.—Housing scheme (12 acres), Cookoo Lane; houses (222), Bedminster & Speedwell housing estates (£87,000); city engineer.

BROCKENHURST.—Isolation hospital (£15,000) for Hants C.C.; clerk, Winchester.

BROMLEY (Kent).—Housing scheme (64) for the R.D.C.; surveyor, Orpington (returnable deposit of £2 2s.). Houses (178), Grove Park estate, for F. H. Ayling, builder, Sydenham Road, North Croydon.

CARLISLE.—Extensions, Garlands Hospital (£14,200), for Cumberland C.C.; clerk, Carlisle. Waterworks (£62,000); water engineer.

CHICHESTER.—Graylingwell Mental Hospital for West Sussex C.C.; Gardiner & Theobald, 96, Gower Street, London, W.C. (returnable deposit of £5 5s.).

CONGLETON.—Housing scheme (75) for the R.D.C.; Price and Son (32); Cyril Massey (22); and M. Longley, Macclesfield (21).

DARWEN.—Public baths (£35,000): borough surveyor.

DURHAM.—Schools: Blackhall Colliery (336 places), Billingham (1,400), Barnard Castle (200), Cockton Hill (350), Whickham (350), Easington Colliery (800), Horden (800), Hurworth (175), Murton (360), Spennymoor (450), Sacriston (350), Trimdon Grange (300), Wheatley Hill (360), West Pelton (350), Seaham Harbour (400); director of education, Shire Hall, Durham.

DURSLEY.—Housing scheme (100) for the R.D.C.; surveyor.

EASINGTON.—Sewage works (£200,000); R.D.C. surveyor.

EAST RIDING.—Grammar school extensions, Beverley (£23,100); county architect, County Hall, Beverley.

ECCLES.—Bank for the Manchester & Salford Trustee Savings Bank; secretary.

EDINBURGH.—Housing scheme (108), Redbraes, for the T.C.; burgh surveyor.

FARNWORTH (near Bolton).—Houses, Openshaw Place (149), Fern Street (34), and Norris Green (9); F. Ashton, surveyor to U.D.C., Town Hall (deposit £2).

FAVERSHAM.—Houses (80), Canterbury Road, for T.C. (£21,284); Whiting Bros., contractors.

FOLKESTONE.—Additional 100 houses for the T.C.; borough surveyor.

HAMPTON.—Houses (124), Markbury estate (£63,806); East Kent Building Co. Houses (88) for R. Hewett, Ltd., Holly Lane and Broad Lane; R. H. L. Barrett.

HELENSBURGH.—Conversion of cinema into dance hall; G. W. Smith.

HETTON-LE-HOLE.—Housing scheme (150) for the U.D.C.; surveyor.

IRISH FREE STATE (Cork).—Improvement of hospital accommodation at Cork County House, Douglas Street, for the South Cork Board of Public Assistance; B. O'Flynne, engineer.

(Athlone, Co. Westmeath).—Houses (44), Campbell's Field site, for the U.D.C. (£15,139).

(Bray).—Technical school; Wicklow Joint Technical Instruction Committee.

LANCS.—Secondary school, Ulverston; S. Wilkinson, county architect, 16, Ribblesdale Place, Preston. School, Golborne, for Lancs. E.C. (£18,500); Derbyshire, Jackson & Co., builders, Wigan.

LIVERPOOL.—Ice rink; Councillor D. French.

LONDON (East Ham, E.).—Extensions, isolation hospital (£38,500) and poor law hospital; borough engineer.

(Ilford, E.).—Houses (72), Clinton Avenue; A. J. Jennings.

(Becontree, E.).—Houses (4,500), L.C.C. estate (£2,115,000); C. J. Wills & Sons, Ltd., contractors for L.C.C.

(E.C.).—Offices, Charterhouse Street (£14,160); L. & W. Whitehead, Ltd.

(Hampstead, N.W.).—Extensions, North-Western Fever Hospital, Lawn Road (£119,000); L.C.C. architect.

(Woolwich, S.E.).—Factory at rear of 403-435, Woolwich Road; George Pearson & Son.

(Greenwich, S.E.).—Offices and stores, Horn Road; Shell-Mex, Ltd.

(Honor Oak, S.E.).—Bank for Barclays Bank, Ltd.; Ward and Paterson, Ltd., builders, Broadway Court, S.W.1.

(Westminster, S.W.). — Tenements, Vincent Street (£101,867); Humphreys, Ltd.

LUTON.—Schools, Maidenhall Road, for the borough E.C.; Brown & Parrott, architects.

MAIDSTONE.—Fruit-canning factory, British Canners, Ltd.; G. W. Cadbury, managing director.

MALDON (Essex).—Housing scheme (50) for the T.C.; borough engineer.

MANCHESTER.—Erection of factory, Hamilton Road, Longsight; Broughton, Atkinson & Eagle, architects, 37, Brown Street.

MITCHAM.—Additional 105 houses for the U.D.C.; R. M. Chart, architect. Offices and council chamber (£11,750) for the U.D.C.; E. H. Smith, builder.

NORTHAMPTON.—Ophthalmic block, Northampton General Hospital (£10,000); secretary.

NORTHANTS.—Schools, Boughton, Weston Favel, and Rushden, for the Northants E.C.

NORTH RIDING.—Secondary school, Askrigg, for North Riding E.C. (£12,140); W. Birch & Sons, Ltd., builders, York.

PORTSMOUTH.—Development, Highbury estate, Cosham; G. Mitchell. Extensions, Royal Portsmouth Hospital; governors.

PRESTON.—Council offices, Guildhall Street (£10,000); surveyor to R.D.C.

ROMSEY (Hants.).—Housing scheme (34) for the R.D.C.; C. W. P. Dyson, surveyor (returnable deposit of £2 2s.).

RUNCORN.—Houses (50) for the R.D.C.; Clough & Gaskell, Ltd., builders, Wigan.

SLOUGH.—Houses (70), Lake Avenue and Woodland Avenue, for W. & H. Bolton. Shops (17), Farnham Road, for W. Gradwell & Co.

SMETHWICK.—Law Courts (£15,000); borough surveyor.

SOUTHWELL.—Refuse disposal works (£10,000).; R.D.C. surveyor.

STAFFORD.—Housing scheme (58) for the T.C.; W. Plant, borough engineer (returnable deposit of £1 1s.).

STIRLINGSHIRE.—R.C. school, Denny (£18,000), and additions to Larbert Central School (£40,000) for the County Education Authority; the Master of Works.

STOCKPORT.—Schools and extensions for the borough E.C. (£133,100); director of education.

STOURBRIDGE.—Assembly Hall, &c., King Edward Grammar School (£12,000); the governors.

THORNTON CLEVELEYS.—Public library, Rossall Road and West Drive; surveyor to U.D.C.

TIPTON.—Domestic centres, handicraft centres, and school extensions for the E.C.; Scott & Clark, architects (returnable deposit of £3 3s.).

WELTON (Lincs.).—Housing scheme (38) for the R.D.C.; surveyor.

WEST RIDING.—Secondary school, Lofthouse, for the West Riding E.C.; H. Wormald, architect, County Hall, Wakefield.

WHITEHAVEN.—School (400 places) for the borough E.C.; T. C. Bone, secretary.

WORCESTERSHIRE.—Senior school, Halesowen, and extensions, Silver Road school, Wythall, and Valley Road school, Lye, for the Worcestershire E.C.

WOLVERHAMPTON.—Senior and junior school, Bushbury Hill (£34,500); F. & E. V. Linford, builder, Cannock. Technical college; T. A. Warren, director of education, Education Office, North Street (deposit £10 10s.).

WREXHAM.—Electric lighting installations in 57 houses, Huntroyde estate, for the T.C.; J. W. Williams, borough electrical engineer.

WYFORD.—Mental institution; Berks. Bucks. & Oxon. County Councils.